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INDEX TO CONTENTS, PAGE 49 . . . . . ADVERTISERS' INDEX, PAGE 22.



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STEEL CONSTRUCTION

*Pittsburgh*

# THE UNITED GAS IMPROVEMENT COMPANY,

PHILADELPHIA.

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## THE STANDARD DOUBLE SUPERHEATER

## LOWE WATER GAS APPARATUS.

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OF

AIR AND STEAM SUPPLY

(PATENTED),

AFFORDING { PERFECT CONTROL OF GENERATOR FIRE CONDITIONS.

PRODUCING { UNIFORM RESULTS. HIGHEST EFFICIENCIES.

THE AMERICAN
# GAS LIGHT JOURNAL
INC.

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## CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

Industrial Fuel, by an Experienced Engineer—Concluded from Page 35 ..... 49
Explosive Gases in Sewers, by G. J. White ..... 51
Societe Technique de l'Industrie du Gaz en France ..... 53
*The Large Quantity Measurement of Artificial Gases in Distribution Systems, by J. C. Wilson ..... 54

OFFICIAL NOTICES—
New Jersey State Gas Association ..... 56
Michigan Gas Association Meeting ..... 56

EDITORIALS—
German Gas Exposition and Meeting of German Society of Gas Engineers—[Special Correspondence] ..... 56
Briefly Told ..... 57
Industrial Fuel Sessions at Minneapolis Meeting, National Commercial Gas Association—Distributing the Booklet "Gas Equipment of the Home."

SPECIAL ENGLISH CORRESPONDENCE ..... 61
The Liverpool Meeting of the Institution of Gas Engineers—Regulations Governing Outside Lighting, etc., in London.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES ..... 62
Galveston, Tex., Good Service Club—Gas on the Battle Field—Ohio Cities Gas Co.—Test of Providence Gas—Municipal Management—Co-operation—Personal—To Build at La Junta, Col.—Columbus, Ind., Demonstrations—Officers of Auburn, Wash., Company—Waterbury, Conn., Plant in Market—Battle Creek Change—An Old Employee—Georgia, Active—Mr. Little Resigns—Davis & Farnum to Build Holder—New Bristol Branch—Street Lighting Fixtures, Lebanon, Pa.—Scranton, Pa., Advertising—Gains by Boston Company—And Other Items.

Recent Patent Issues ..... 63

UTILITIES COMMISSION NEWS ..... 64
Reduction for East Boston, Mass.—Cumberland (Md.) Company to Liquidate—Resigns from Maryland Commission—Idaho Commission Upheld—Ice is not a Public Utility—Ohio Depreciation Accounts.

Financial Notes ..... 64
Public Lighting Table for August, 1914.....(Advertising Section) 10
Meeting Times of the Various Gas Associations " 27

[Concluded from page 35.]

## Industrial Fuel.

By an EXPERIENCED ENGINEER.

Having educated ourselves and our employees, installed a small industrial display, and obtained a line of advertising matter, we now will make a list of prospects. The next step is to get permission to go through the factories and shops, preferably from the General Manager or the person who will have the deciding answer to give, with a view of ascertaining how they are doing their work, and what the possibilities for gas are. Very few concerns refuse this permission, especially if they understand that you want to see whether you can help them to turn out a better product or at a lower cost. In small towns where there are no factories, you still have your blacksmith shops, automobile repair shops, etc., besides the concrete block makers and contractors. All these are prospects. Don't forget the candy shops, and that there is such a thing as a gas engine which often can show good saving in power generating. If now you have obtained consent to go through the establishments, after you look over the ground it is up to you to cultivate the friendship of the foreman, and the men doing the work, in order to learn from him what he is doing. Find out all the conditions; what the product should be; how long it takes to do it; what the waste is; and what it is costing. You will need a good stop watch as time saving will be one of your best talking points. Be sure you have carefully studied the conditions of this one process and that you are posted on all its details. If, for instance, a man is using a tinning furnace which is fired with coal or coke, know how much coal or coke it burns, how much time it takes to bring the metal to the proper heat, what the waste is in burnt metal, the percentage of defectives, and how much time it takes to tin the article. Note the temperature in the working room, get the workman to tell you his troubles, let him talk of the hot summer and how he is fading away in the awful heat. Know that he can turn out only so many, of such and such, per day; and in the meantime talk to him first of the comfort he would have if gas was used, and how much easier it would be for him. But be very careful in telling him of the labor saving, as many men like to nurse a job along. The vital information for you, is what you get from the man on the job. Don't be afraid to ask questions; don't make him think you know it all. Let him feel that he is the source and he will tell you things you never thought of. Be sure your information is correct in every detail, and that you have actual results to work with. After you have gotten all the necessary information, go to your reference library and catalogues and ascertain the best type of gas apparatus for the work. If you have no data write to the Bureau of Information of the different gas associations and to appliance manufacturers. Don't write to one, write to two or three, for they may not agree. After you have decided on the best piece of appliance for this particular operation, go to the head of the establishment and show him what you can do and will do. If you interest him, offer to place the appliance on 60 days' trial; and most all the better appliance companies will let you install appliances on those terms. Now it is up to you to get the workman and the foreman to help you. Teach them how, and watch them until they can do it, and above all teach them economy first.

Don't start with the largest piece of apparatus, and above all don't try to load the establishment up at once. Begin with the appliance most needed and most used, and after you have shown that you can make your word good on that, your way is easy for the other appliances. Many failures have been caused by trying to get too much at once. Remember you are educating the heads of the establishment on a new line, and don't expect them to run before they know how to crawl. Besides, a $100 gas bill looks awfully big to a man who has never seen one for more than $2.50, even if he did use it. After you have gotten one appliance working to his satisfaction, then try another. Keep the workman in your camp, besides the foreman and the superintendent; and you must be a diplomat to have them all with you. I know of an instance where the first appliance was a glue heater; next two small soldering iron fornaces; and after 9 months this establishment was using 450,000 cubic feet of gas per month, and were absolutely satisfied.

In another instance (a newspaper) where the gasoline burner on the linotype machine was replaced with a gas burner for a start, next came the matrix table, and so on down the line until even the pots holding 3,600 pounds of metal were gas fired within a year. I know of a railroad shop where the first installation was a small torch for burning paint from cars. Then some soldering iron furnaces were put in, and to day they have tire removers and shrinkers, melt-

ing furnaces, and welding furnaces; and 400,000 cubic feet of gas per month is considered small consumption. I know of a town of less than 8,000 inhabitants with a small railroad repair shop where the start was a small bunsen burner for kindling the fire in locomotives, and to-day they are burning a very large quantity of gas.

Never, under any conditions, try to rebuild the old coal furnaces to burn gas. Don't put gas in a furnace built for coke, or try to use a steam kettle. Buy a furnace built upon scientific lines for gas only, and you will get the best results. Furnaces built for coal are in no way suitable for gas, so don't fall down. Above all, take lots of time before you make any assertions, for if you fail, you are in a worse position than if you had not attempted to get this consumer. Be sure you understand all conditions, and never, under any circumstances, take the word of someone else as to what they are doihg. Listen, but find out for yourself. As an experience of this kind, the writer once interested the master mechanic of a railroad in the installing of gas. I was given permission to visit their shops, there met the local master mechanic who was also very glad to assist in every way possible. Both of these said they were using crude oil and paying so much per gallon for it. After looking over the ground it was decided to make the first trial on a small furnace used for heating the ends of boiler tubes, for welding, etc. After two days I found that they were not using crude oil but a mixture of that oil and kerosene, gotten up by the foreman and superintendent who kept this information to themselves. In fact, the actual cost was three times what the master mechanic thought, and it made it just that much easier to install gas appliances. This information was given by a workman, and illustrates that a great deal of assistance may be had by co-operating with the man on the job. Do not find fault with the process, but get the workman in your confidence; remember he is the man who can either make gas, to a very large extent, a success or a failure. Information from this source is usually reliable.

If you can improve the process of manufacture the authorities are interested, but convenience and personal comfort is what appeals to the laborer most, not time or money saved. In getting information a good maxim to remember is "that you can get more information with a cigar than with a ten dollar bill."

When you are ready to get the appliance from the maker, remember that you must get the one that is the most efficient and economical. Do not buy a furnace that you saw in Chicago just, because conditions look similar, for you might have the wrong furnace entirely. A furnace doing certain work in New York might be useless in Chicago, unless conditions, etc., are the same. I have seen soft metal furnaces used that could in no way be used for another soft metal. When you purchase an appliance buy quality, don't buy because the salesman is a good fellow. Do not investigate the appliance of only one company; get ideas from two or three of them. Write them all your problem and get their help, until you are absolutely sure you know what you want. After a few attempts you will school yourself and will realize why one make is better than another. The writer one time had some business with a candy company that had purchased from the makers some furnaces recommended to them as good gas furnaces. The gas company had one continual round of complaints of high bills, etc. Upon investigation the furnace was found to be using 2½ cubic feet of gas per pound of candy, and that they had originally been built for natural gas. After a great deal of trouble the gas company induced them to install a candy furnance of its selection; and with the same type of candy, and practically the same weight, these furnaces consumed only 1$\frac{1}{8}$ cubic feet per pound of candy. This shows the great difference there is in the construction of furnaces. In another case a metal working factory purchased three furnaces from an outside source and tried their best to get results, but failed absolutely. To do a certain amount of work it took 27 hours continual running of the furnaces and the finished product was full of discards. They had so much trouble that they started to install oil furnaces. Finally, after a lot of trouble, the gas company induced them to try another type of furnace; and the same amount of work was done in 8 hours, and there were no discards. This shows that there are material differences in furnaces. My maxim, which has worked well in this regard, is "Sell a consumer what he needs and ought to have to get the best results; and not what he thinks he wants. Show him once and he will be guided by your judgment always." Be careful about your first purchase and installation and you will never have any trouble. There are plenty of reliable appliance manufacturers, all of whom will be pleased to assist yon.

After you have the proper appliance, the next important step is its installation. Remember that you can get more gas through an 1¼-inch pipe than through a 1-inch and that too large a line is a whole lot preferable to too small a one. The fitter who does this kind of work should do all of it. He should have his work supervised and inspected by the Industrial man or whoever is handling the industrial division. He should be encouraged to read along industrial lines, and some day he may make a good industrial salesman. In fact, it is from the fitters that some of our best men are recuited. When you are putting in the installations, bear in mind, that one of your talking points was cleanliness, so you must see that your work is done in a neat and workmanlike manner. Do not allow a pipe to be soaped up if it has a small leak. Take it down and use another fitting. Do not allow a fitter to use a number of bushings to reduce an opening just because he has no reducing fitting at the moment. You are trying to impress them with the neatness of your work and must also consider the minimum space needed., etc. Use good black pipe and good substantial fittings. When the appliance has been properly installed, it is up to you to instruct the workman how to use it. You must teach him how to use gas economically and with efficiency. Let him know that every second he leaves the burner lit cost money. Teach him all the why's, how's, wherefores, etc., of the appliance. If you have any literature give it to him. Spend a day or two with him, or a week if necessary. Then take up the subject with the foreman and superintendent. Have your appliance connected direct to a meter so that you can read the meter periodically. Show them what you are doing and with the help of the foreman and superintendent get your data, and get it right. Then after the 60 days trial you are able to talk business. A good way to obtain the data is to leave a helper or fitter on the job to count the articles and get the other information, with occasional visits by yourself. After you are satisfied that you have the right figures and that they will be interesting to the authorities, place them before them in a neat manner, preferably in a type written report. Don't make exaggerated claims, but just show what you have done. That is enough to convince them if you have the word and co-operation of the head of the department. There are very few men who can not be convinced by arguments of that kind.

One word must be said about blast apparatus. Be sure you have air enough. Remember heavy or high air capacity is a great advantage, and wherever heat and metal are concerned blast burners are preferable to atmospheric burners under all conditions. I have personally made it a rule and found it excellent practice to use blast burners on all appliances from peanut roasters upwards. Small combine motor and blower sets can be purchased and there is a big advantage in using individual blowers where the process is not continuous. I know a candy company which installs a blower and motor set for each two furnaces. These are placed by the furnaces and turned on and off as required. Where the furnaces are used continually and there is little variation in the air pressure one large unit may be installed. Do not expect to install a dozen or more furnaces and get good results if the air pressure is continually varying due to the turning on and off of appliances.

Now about getting your money, after your installation is satisfactory and accepted, There is an old maxim "that anyone can sell goods, but it takes a real salesman to sell and get the money." The average solicitor judges his ability by the number of stoves, lamps, etc., he sells, not by the price obtained or the sales conditions. There are times when the large first cost will deter a prospective consumer or purchaser from considering the installing of gas fired appliances. Don't expect to make a large profit on your industrial appliances, because you are in business to sell gas and service; and appliances that are the most efficient bring this. A good method is to sell the installation at 10 or 15 per cent. above the actual cost. Some gas companies purchase their fuel appliances on time, but this must be left to the discretion of the manager. A good way to sell an appliance is at so much per thousand cubic feet used by the apparatus per month. For instance, if a factory uses its appliances all day they have turned out more product, which means more gas used, and are therefore in position to pay more towards the appliances itself.

Some companies sell appliances at 10 cents per 1,000 cubic feet used, if they cost less than $100; and 15 cents per 1,000 for those above that cost. In other words, if a factory consumed 100,000 cubic feet of gas during the month they would pay $10 towards the appliance; if it cost more than $100, $15, and so on. Interest at 6 per cent. is sometimes added. This gives the factory about a year to pay for an appliance; and additg 10 or 15 per cent. to the cost gives an op-

portunity to allow a discount for cash. On small burners a reasonable profit ought to be made. Don't give appliances away, but don't ask too much for them.

A big factor in the industrial fuel department is what price you can give the consumer for gas. Don't expect a large consumer to pay the regular domestic rate. The establishment of "Readiness to Serve" and sliding scale rates have been very satisfactory. Make your price range so that there is some inducement to use more gas, and that the more he uses the cheaper his unit rate becomes. All electric companies make special power rates, why not the gas companies? Consider in making your rate, that with this additional load you have no extra mains to lay, no extra investment; you need no extra help in the office, and that you need not trouble much with such consumers. That your complaints are few if your installation is right, that each industrial consumer helps reduce your overhead per 1,000 cubic feet. They give you a way of increasing earnings at a minimum expense. You can work nearer to your peak load, and a good peak load means better results in all divisions.

Remember it takes time to get an industrial consumer interested. If you have an industrial man don't expect him to land a consumer every day, or judge him by the number of installations made. It is cubic feet sold that counts. As an instance, in one installation now using 5,000,000 cubic feet gas per month, it took nearly two years to bring the company around. The original start was a small Babbit furnace, and then a study of conditions. Begin small and build up, rather than aim too high and fall down. In one candy company the first appliance installed, after five months work, was a batch heater or warmer; then came a peanut roaster; then a candy furnace. It ended in 16 furnaces; as many chocolate cookers; about thirty batch warmers; cooling and heating as well as dipping tables; and two gas fired steam boilers to generate steam for cooking special candies. Don't ever fall down, for a manufacturer that has been "burnt" or had a costly experience, will be a lot harder to interest, than if you never tried. Besides, he will be the worst enemy and element you will have to contend with in getting other business. Start on one place and get that working right; the others will be just so much easier. It takes lots of time, and many examples could be given to show that a slow-coming industrial consumer is usually the best in the end. I know of one case where the start was made with a small bench forge only large enough to heat a ½-inch rod, which after two years had four large forges, two special hardening machines, and a number of melting furnaces, including two brass furnaces and a number of special annealers, etc., with gas for lighting. In fact, they are now so well satisfied that they look for opportunities to install gas fired appliances.

Another thing to consider deeply is the care of the appliances after they are installed and accepted. At first a weekly visit should be made, this can after a while be reduced to once or twice a month, but show the consumer that you are looking after him. See that his burners are clean and that the appliances are giving complete satisfaction. With candy furnaces there is a tendency to let the candy which has boiled over from the kettle and run down upon the furnace to stay there. After a while this becomes hard and carbonized, or gets into the burners. Show the users how to clean them and if the factory wants to, make arrangements to take care of them for cost of labor and material. An excellent plan is to arrange with the different industrial consumers to overhaul and clean and put in first class condition all their fuel appliances when they are shut down taking inventory, etc. This gives a feeling of security to the consumer, and he feels right towards you for it.

The gas engine is a good business proposition especially in certain localities, but is too large a subject to cover in this article. Taking into consideration some of the electric rates, there are some large fields untouched which would be excellent gas engine prospects.

Don't become discouraged if you feel your prospects are few, remember the old adage, "Find a way or make one." Did you ever realize what excellent industrial prospects your building contractors are? Have you ever considered the gas they might use if you know what to sell it to them for. I know plants that have purchased gas engines and rent them out to contractors at so much per horse power per day. These engines are used for turning concrete mixers, running elevators, etc., in place of steam and gasoline engines. There are good talking points too, such as reliability, readiness at all times, abatement of smoke nuisance, cleanliness, saving of investment. Good service is what counts with them, and besides there is the saving in labor. Change their gasoline engines over to gas engines. Your newspapers and city officials will be with you in this. An engine can be installed anywhere. They make no smoke covered walls, or trouble with the surrounding people. Where a new building is to be erected, you can easily run your service first, or install a temporary service. I know of one paving contractor who used a gas engine for concrete work, the supply pipe laid along the parking of the street. He was well pleased and got most efficient results. Have you ever considered renting out an automatic water heater to the concrete contractor, who wants hot water to mix his concrete in the fall and winter? You can install the heater in the street; build a wooden housing around it with a removable top, taken off when the heater is in use and replaced at night, and all that is needed is a few holes to let out the products of combustion during the night and the pilot burning high enough to keep the heater from freezing.

In a small town a bridge company built an iron railroad bridge, and the gas company sold them gas for rivet heating and tool dressing. These only show the possibilities that the gas man can find and all he needs is a little American horse-sense to find some way of getting to them and keeping them.

But all of the above is of no avail unless you are putting out good gas. Remember in order to get high class results your gas must be clean. So begin at the works. Don't sell a metal worker gas that is a little richer in sulphur just because your purifiers are dirty, and you have no clean oxide on hand. Don't forget your distribution system, see that you are in a position to give steady pressure and lots of gas. Don't try to get a consumer on a poorly laid distribution line and expect to keep him if he is without gas now and then. Your two necessities are clean and good gas and good distribution service.

To itemize the different usages of gas for industrial purposes is impossible; but wherever heat is used, no matter in what form, there is a possibility and prospect for industrial gas. Gas means to everyone better products, more work done and less capacity of installation. In other words, it means efficiency and economy. No city or town is too small. Even the village blacksmith shop is a prospect. Too much stress cannot be placed on these facts and the time is rapidly coming when every company, no matter how small, will have a measure of industrial gas sales.

The establishment of testing departments for testing and establishing standards for industrial and other appliances is now being considered by the gas associations, which will help towards the end "that the time may soon come when it will be considered barbarous to use coal or wood in their crude forms for manufacturing purposes or the creating of heat."

## Explosive Gases in Sewers.

By G. J. White in *Engineering News*.

Explosions of gases in sewers, while not of very frequent occurrence, constitute a serious danger to both life and property in cities. A discussion of the various gases which may ordinarily collect in sewerage systems will serve as an introduction.

*Air.*—Air consists of approximately 20.96 parts of oxygen, 79.0 nitrogen, 0.04 of carbon dioxide and other impurities, by volume. It is colorless and odorless, has a specific gravity of 1, the basis to which the specific gravities of other gases are referred. It is not explosive in itself, but furnishes the oxygen necessary for the explosion of other gases, which by themselves may be nonexplosive.

*Sewer Gas.*—Sewer gas consists appoximately 90 parts of nitrogen, 2 to 4 of oxygen, 1 to 3 carbon dioxide, 3 to 5 of carbon monoxide, methane and other gases, by volume. Its specific gravity varies with its composition and is approximately the same as air. It has an odor due to the organic decomposition constantly going on in the sewage. It is not poisonous in the true sense of the word, but due to its high percentage of nitrogen and low oxygen will not support respiration, and hence a person is slowly smothered in an atmosphere of this gas. It is nonexplosive in itself and, due to its high nitrogen and low oxygen content, will prevent the explosion of otherwise explosive gas when mixed with it, unless some other gas such as air is added to furnish the necessary oxygen for combuston.

*Coal Gas.*—Coal gas is made by the destructive distillation of high-volatile coal in retorts. Its composition varies with the kind of coal used and the details of manufacture. It consists of approximately 3 parts of illuminants (ethylene, etc.. of the $C_nH_n$ group), 35 to 40 of marsh gas, 45 to 50 hydrogen, 4 to 8 carbon monoxide, 0 to 2 oxygen, 1 to 2 carbon dioxide and 3 to 5 parts nitrogen, by volume. It is colorless, and has a strong penetrating ordor, so that a small per-

centage mixed with air may be readily detected by the smell. In itself, it is not explosive, and must be mixed with air or some other gas which will furnish the necessary oxygen for combuston. A cubic foot of coal gas requires about 1.21 cu.ft. of oxygen for complete combustion. If we allow 20 per cent. of oxygen in the air, then $1.21 \times 5 = 6.05$ cu.ft. of air is necessary to furnish the oxygen for the combustion of 1 cu.ft. of gas. An explosion will take place with mixtures of from 4 to 12 parts of air with one part of coal gas, the intensity of the explosion varying with the mixture. The specific gravity of coal gas varies with its composition from 0.50 to 0.60, or it is about one-half as heavy as air.

*Water Gas.*—Water gas is made by passing steam through a bed of incandescent carbon, and has a comparatively low heating value and relatively small candle power. Therefore, it is enriched by admixture of oil gases while passing through shells filled with checker brick, which are heated to incandescence. The composition of enriched water gas approximately 25 per cent. carbon monoxide, 10 per cent. illuminants, 30 per cent. of hydrogen, 1 per cent. oxygen, 3 per cent. carbon dioxide, 25 per cent. methane and 6 per cent. nitrogen, by volume. It is nonexplosive in itself and must be mixed with air or some other gas which will furnish the oxygen for combustion. It has approximately the same explosion range as coal gas. It is extremely poisonous, due to its high carbon-monoxide contents, and has a penetrating ordor, even more noticeable than that of coal gas. Its specific gravity varies from 0.45 to 0.55.

*Coke Oven Gas.*—Coke oven or Solvay gas, like coal gas, is made by the destructive distillation of coal in ovens. In coal-gas manufacture, the gas is the main product, while coke is a secondary or residual product. In coke-oven gas manufacture, the coke is the main product and the gas a secondary or residual product. The composition of Solvay gas is similar to that of coal gas. Like coal gas, it is nonexplosive in itself, but becomes explosive when mixed with various quantities of air. The range and the intensity of the explosion are appoximately the same as those of coal gas.

*City Gas.*—Illuminating gas or city gas as generally distributed, may be coal gas, water gas, oven gas, or a mixture of any two or all of them. It has ordinarily a specific gravity of 0.50 to 0.60 or about one-half that of air. It is nonexplosive in itself, and will explode only when mixed with 4 to 12 volumes of air. City gas stored in a gas holder would not explode if the holder were struck with lightning. If the tank was ruptured sufficiently to let any large amount of gas escape, there would simply be a flash similar to that following the throwing of a lighted match into an open barrel of gun-powder. I have seen workmen mark leaks on a gas holder by igniting the gas issuing from the holes.

*Gasoline.*—Gasoline varies in specific gravity from 0.70 to 0.74 Baumé. 0.70 is a light grade, and 0.74 is termed stove gasoline from its general use for heating. The analysis of the 0.71 gravity gives carbon 838; hydrogen, 155; impurities, 7 in 1,000 parts, with a heating value of about 18,000 B.T.U.'s per pound. The vapor of gasoline is equal to 160 cubic feet per gallon, or about 1,200 times its liquid bulk. It is non-explosive in itself, but mixed with air is used as an explosive power in automobile engines. The boiling point of gasoline such as is used for explosive engines, ranges from 150° to 180° F., and the flashing point 10° F., with complete combustion of the vapor. The vapor of gasoline from 1 pound of the liquid requires 189 cubic feet of air and as 1 pound is equal to 26 cubic feet of vapor, $^{189}/_{26} = 7.3$, so that one part of gasoline vapor with 7.3 parts air may be used to produce a perfect combustion. Less air will leave an unconsumed residium, while an excess of air will lessen the intensity of the explosion, and if the excess is sufficient will prevent the combustion. Gasoline vapor has, when mixed with air, an explosion range from 2 parts air with 1 part of gasoline vapor, up to 19 parts air to 1 part gasoline vapor, the intensity of the explosion varying with the mixture. The specific gravity of gasoline vapor is from 1½ to 2½ times that of air. It is colorless and has a penetrating odor.

*Sources of Gas Vapors in Sewers.*—Our cities are covered with a network of pipes used in the distribution of illuminating gas. Breaks in these gas mains may lead to the escape of this gas into the sewer systems. Due to the comparative depth of trunk sewers and gas mains, it is not likely that any great amount of illuminating gas gets into the trunk sewers themselves, but we do find it in lateral sewers, telephone and electric light conduits, where comparatively small amounts would be necessary to furnish an explosive mixture. Where telephone and electric light conduits have untrapped connections to the main sewers, there will be a tendency for any gas present in the main sewer to escape into these conduits. Since it is only one-half as heavy as air, it is more likely that illuminating gas getting into a main sewer would tend to work its way out through the lateral sewers which feed into it, or through the openings in the manholes in the main sewer. The odor of illuminating gas escaping from a sewer would be decidedly noticeable long before sufficient gas to form an explosive mixture was present.

In the summer, the temperature of the floors of garages and pavements of a city are at or above 50° F., the vaporizing point of gasoline, so that any gasoline spilled on the pavements or on floors of garages would evaporate and mix with large volumes of air, in which condition it is not explosive, and not reach the sewers. In the winter the reverse is true. The temperature of the pavements and the floors of garages is below 50° F., so that gasoline spilled is very likely to reach the sewers. The temperature of the water in the sewers varies from 40 to 60° F,, so that it is quite likely all of the gasoline which reaches the sewer is vaporized there. Since the specific gravity of the gasoline vapors is 1½ to 2½ times that of air, these vapors will follow the surface of the water and not escape from the trunk sewers through the lateral sewers and the manholes. During the winter, most of the pavements are covered with ice and snow, and gasoline spilled on the pavements freezes and becomes mixed with ice and snow so that when we get warm rainy days, the snow melts, thus releasing the gasoline. We may expect to find an unusual amount of gasoline in our sewer system following a heavy winter rain which at the same time forces in large quantities of water and air. We may then expect to find the sewer gas containing unusually large amounts of oxygen which are necessary for an explosion. That is, the average sewer gas when mixed with any gas alone in any proportion could not explode, due to the high percentage of nitrogen and low percentage of oxygen.

We must have oxygen as well as gas or gasoline vapor present in a sewer to form an explosive mixture. To furnish oxygen, we must have fresh air, as air which has stood any length of time in contact with sewage is robbed of its oxygen. So we must expect these explosions to occur after a period of rainy weather. Dry-cleaning establishments use large amounts of gasoline in their processes, employing it over and over until it becomes too dirty to be used any longer. The easiest way to get rid of it is to put it in the sewer, and analysis of some sewage has shown as high as 1 gallon of gasoline per 1,000 gallons of sewage. This is an extremely high content, and if it were general, the gasoline vapors in many sewers would be explosive at all times, if sufficient oxygen were present.

*Means of Ignition.*—The streets of our cities are underlaid with telephone, electric light, street railway and power cables. Evidences of leakages from underground electric systems is given by the corrosion of water and gas mains by electrolysis. An electric spark due to this leakage would ignite any gas mixture which is explosive. Sometimes the side of a manhole cover is cut off to make room for a street car track. A spark from the car wheel as it goes by the manhole might ignite the gas mixture. A fire engine passing over the manhole might drop a spark in an explosive mixture. The flame from a lantern taken into a sewer by careless workmen may cause an explosion. A lighted match dropped on a manhole cover may cause an explosion. In fact, there are many ways in which an explosive mixture may be ignited.

Curves in the trunk sewers offer a resistance to the free flow of gases through them, causing the gas to bank-up at these points. Changes in cross-sectional area in the sewer have the same effect. At these points, we may expect to find explosive mixtures if they are present anywhere. When a means of ignition is furnished, the explosion occurs at the points where explosive mixtures are present. The primary explosion forces the gases through the sewers, putting them under pressure, in which condition a gas which under atmospheric pressure is not explosive, may become explosive. The ignition wave follows the pressure wave and as a result there is a series of explosions throughout the sewer, until a point is reached where the gases are not explosive.

*How to Prevent Explosions.*—This is a case of either elimination of the explosive gases or ventilating the sewers. It is impossible to absolutely prevent leakages from illuminating gas mains getting into the sewers; it is impossible to keep sewers absolutely free from gasoline vapors; and it is impossible to always eliminate curves in the sewers.

It is then more a question of ventilation. The openings in manhole covers are designed to do this; but if they are allowed to become clogged with dirt and snow, they do not fulfil their mission.

Manholes are usually at least one block apart. If there are sharp curves or change of cross sectional area in a sewer between two manholes, it is most likely that explosive mixtures will be found there. Then the curve must be ventilated, which may be done by means of a stack built inside of the curb line with a conduit running to the top of the sewer. If the natural draft is not sufficient to ventitate the sewer it may be necessary to resort to artificial draft through this stack. If these danger points are not equipped with stacks, removing the manhole covers for a few hours during the rainy days of winter will provide sufficient ventilation to prevent explosions. There need be no fear of a serious explosion in a straight-barreled sewer at any time. There need be no fear of a serious explosion in any sewer during dry weather. Rainy days during the winter are the danger periods and if care is taken to provide sufficient ventilation at the danger points during these periods, the writer believes that sewer explosions may be eliminated.

## Societe Technique de l'Industrie du Gaz en France.

The Société Technique de l'Industrie du Gaz en France held its 41st annual meeting, in Paris, during the week of June 13th. Wednesday morning saw the members assembled for their annual business meeting at 9 o'clock, and at 14 o'clock (French for 2 P.M.) came the formal opening of the congress and the distribution of prizes and awards, followed by the reading of technical papers; and at 16½ o'clock a visit to the La Villette gas works. Thursday was taken up with technical papers and by a visit to M. Kula's apprenticeship school, and in the evening, at 19½ o'clock, was the annual banquet of the Société, at the Grand Hotel. Friday morning was given to the reading of papers; and in the afternoon the members went to Lyons, where the programme included lectures upon works to be visited, an inspection of the Lyons Exposition and a lecture upon it. Other inspections and excursions kept them in and about Lyons until Tuesday P.M., and they reached Paris again on Wednesday morning.

At the Wednesday morning session the Council presented their report, which alluded in feeling terms to the deaths of M. Georges Vizinet, ex-president, and of M. Albert Weiss, of Zürich.

The great majority of the members of the Société are also members of the syndicat Professionel de l'Industrie du Gaz, of which M. Marquisan is again the president and M. Delahaye the secretary. The two bodies have co-operated during the year in dealing with the proposed Government sealing and stamping of gas and electric meters, which now seems to have been dropped. But there is still the danger of the proposed taxes on light. Last year this proposal was rejected, but it does not appear to have been killed.

The general situation of the industry in France is very satisfactory; consumption and new applications show steady progress; for example, in the instruction now given in the girls' schools in the suburbs of Paris, and in the use of gas by the bakers of Paris under the stimulus of the efforts of the Paris Gas Company.

For last year's papers the first prize of £16 was awarded to M. Ab der-Halden for his paper on the estimation of the components of tar by solution methods; the second, £8, to M. Chanial for his paper on the transmission of coke-oven gas; and a prize of £8 to M. Marconnet for his paper on a new type of producer, using powdered fuel.

At the afternoon meeting, after an address by the president, M. Boutan, and the distribution of prizes, came the reports of the committees.

The Committee on Professional Education have not yet been able to start the courses for young engineers, to which reference was made in last year's report, but they hope soon to do so. The committee draw attention to the work done by M. Kula, formerly a plumber of Paris, who some 10 years ago founded a private apprentice school. The guiding idea was that for preliminary manuel training sheet metal working was the most suitable and the most useful in other directions. It gives training in handling of the material, and in precision and method. It opens out in at least 20 specialized directions, and at the end of 2 years the apprentice can choose his line of occupation. The course lasts 2 years, the second-year pupils acting as instructors to the first year's pupils, the practical instruction given by competent workmen. The oral instruction deals with the nature of materials, the elements of designing, the use of the square and compass and arithmetical problems involved; and a course on the development of surfaces. The pupils are taught freehand designing and the reading of working drawings. During 8 years some 2,800 pupils have passed through the course, and all of them have done well. Such a course, the committee add, is invaluable in getting the young worker interested in the work he has to do, and is calculated to be of great service to the gas industry, since it promises a revival of the art of fitting and plumbing.

The Committee on Gas Manufacture note that in Germany there is at present a great difference of opinion on the question of the use of air for continuous revivification. Some of the members of the committee are carrying out tests as to the effect of air on the percentage of hydrocyanic acid in purified gas. It seems that if the velocity of the gas through the purifiers be too great, that is if the purifiers have too small a surface, there is a tendency to an increase in the hydrocyanic acid. This may possibly explain some of the undesirable results which have been observed abroad when air is used. The committee sent inquiries to 24 distinguished workers abroad, asking (1) whether they use continuous revivification; (2) if so, for how long a time; (3) on what quantity of gas; (4) with what proportion of air; (5) are there any changes in the amount of hydrocyanic acid; (6) any increase corrosion of holders or of meters; (7) do they endeavor to promote or to avoid caking of the oxide in the boxes; (8) in what proportion the efficiency of the purification is promoted by continuous revivification; (9) whether any particular grade of oxide suits better than others, and (10) any other observations. The answers showed that 20 out of 24 used air; three have abandoned it because they now use vertical retorts, and push the distillation so far that they cannot afford to have the heating value lowered by the addition of nitrogen; one has given it up because the holder metal was being attacked. In most cases the practice was of more than 20 years' standing, and the quantities treated were from 1,750,000,000 cubic feet per annum down to 175,000,000. In general, they had not analysed the gas for hydrocyanic acid. Wiesbaden found, with 2 per cent. of air, cyanogen average 7 and maximum 10 ounces per 100,000 cubic feet; other works reported that the cyanogen had increased, but that by keeping the percentage of air at 1½ to 2 there was no corrosive action on the holders or meters. In the German works sulphocyanides are formed because the air is introduced before the gas enters the ammonia washer. Dr. Bunte, of Carlsruhe, said it had often been stated that there was corrosion of the metal of the holder, but, so far as his knowledge went, this had not been confirmed.

As to the drying up of the purifying material, the general practice was to inject steam at the inlet of the boxes; sometimes the purifying material is used wet; some said that with modern grids no difficulty is encountered; Berlin gets over any trouble by adding 25 per cent. of powdered coke to the purifying material; Cologne advised the injection of water spray at the inlet of the purifiers. As to the extent to which the efficiency of purification is promoted by the use of air, the replies are rather vague; but it is agreed that there is a saving in labor. Natural oxide and Lux material both have given good results. The purifying material tends to form hard lumps, impervious to air or gas, and the injection of water spray or steam does not appear to prevent this, and 2 per cent. of air then becomes insufficient. The caking can be largely kept in check by Jaeger grids or "Standard" grids; but the handling of the purifying material is then more costly. There seems no radical remedy for the 2 per cent. of air becoming inadequate as the purifying material ages; and the use of oxygen, or of air rich in oxygen, ought to be studied, particularly now that industrial oxygen is becoming cheaper. The best solution of the problem appears to be to use both continuous and discontinuous revivification, the later either in the boxes or on the yard. When the discontinuous revivification is carried out in the boxes, there must be a powerful through draught of air to prevent heating up. At one French works which has but two purifiers the gas has a velocity in the purifiers, in winter, of 0.6 inch per second; and all revivifications is done *in situ* with the aid of an electric fan of 16-horse power, passing 690,000 cubic feet of air per hour. The purifying material is Salindres (a residue from the aluminium works) mixed with 86 per cent. shavings, with an addition at each revivification of a thin layer of bauxite residue), which remains in the boxes for 6 months. The mixture at the end of the 6 months has purified 60,000 times its bulk of gas, or 180,000 times the bulk of the active purifying material. This combination of continuous and discontinuous revivifications works perfectly; but in works of some size it is better to separate the two stages, so that for continuous revivification we would use Jaeger or "Standard" grids, while for discontinuous we would use a single thick layer which can be economically handled, either by being drawn on to the yard, as at Gennevilliers, or revivified *in situ* by an electric fan. In any case it seems clear

(1) that we should introduce the air under pressure and not by aspiration ahead of the exhausters; (2) that we should introduce the air after the gas has passed the "Standard" washer or the scrubbers, and not into the hydraulic main, for though the air can take up benzol from the tars in the hydraulic main, we now know that air introduced into the hydraulic main oxidizes the hot tars and converts them into pitch, and also forms sulphocyanides; (3) that we should make the gas and the air, mixed with steam, pass from above down through the purifiers; and (4) that we should use a cyanide washer.

The committee have also been occupied with the question of the use of small coke in producers for heating retorts. M. Laurain advised last year that coke should not be broken, since it was increasingly difficult to get rid of the smalls; but we have to find a use for a certain quantity of smalls. The use of small coke in producers has encountered certain difficulties; a forced draught is required, either fan or steam injector; to render the fuel more permeable to air we have sometimes used mixtures of coke smalls with coal, or made a kind of coke out of mixtures of coke dust and small coal, or we have used briquettes. Some 20 years ago these methods seemed to have solved the problem; but to-day the difficulty is an increase of clinker in the producers and the trouble occasioned by fusion of the ash. Clinkering by the tool is very hard work, and clearing by making the ash run in a molten condition does not appear to be practical in producers for gas retort firing. Besides, the latter does not do away with the driving of cinders into the burners and flues, where they form deposits which attack the firebrick walls, block up the passages and cause trouble generally.

It is generally impossible, in existing benches, to prevent these troubles; but where we have automatic independent central producers the dust can be deposited, either by centrifugation with injection of spray, washing in scrubbers, or filtration through wet sawdust. Physical filtration is thus possible, but when we consider that the producer gas has to be from 2½ to 3 times the volume of the gas ultimately made by its means, we see how clumsy a method this is, and how costly it must be. And, further, the washing of poor gases causes a loss of heat units, on account (1) of the cooling of the gases and (2) of the condensation of water vapor. The amount of this loss may readily come to 24 per cent. Besides, there may be a condensation of water vapor about the inlet to the benches, with consequences disastrous to the firebrick. On these grounds we seem compelled to contemplate the adoption of separate producers. It will be interesting to see how such systems, now being put up, actually work. While in some places coke dust can hardly be disposed of, in other places there is a good demand for it, for steam raising by means of a coke-dust and-air blast. Still, even in the favored localities, the price obtainable is very low, and the self-clinkering separate producer, though wanting in simplicity and cheapness, may save the situation. The committee have a good many points of detail under consideration in reference to these questions, and hope to report on some of them later.

The Committee on Distribution found nothing essentially new in distribution during the year, though the application of better methods has been greatly extending. Supply of gas to great distances is becoming of more importance; and an example of this is furnished by the intercommunal service in Belgium, where gas is pumped distances of 25 miles, supplying 86 parishes. This system has been in operation 7 years. Important centres have holders, generally those of former gas works, but there are considerable groups which depend entirely on pressure governors. The maximum pressure of 26 feet of water has, since the mains have been enlarged, been reduced to 19½ feet. The amount of fluctuation in the pressure depends greatly on the type of compressor employed—2 inches with a piston compressor, in spite of the use of gas bags; less with a Beale or a Bryan Donkin. And these fluctuations strike back to the holder, so that unless the holder be disconnected from the low pressure supply, great inconvenience may be occasioned. Roots' compressors do not cause fluctuations, but they cannot get up pressures exceeding 10 feet of water. M. Versepuy has undertaken a study of the different types of compressor. He concludes that there are three types of compressor to consider: (1) Alternating piston compressors, give high pressures but cause serious fluctuations; (2) rotary, (*a*) excentric, no high pressures, fluctuations serious, and (*b*) non-excentric, with few or many palettes, giving no fluctuations; (3) centrifugal compressors, (*a*) ordinary, no high pressures, (*b*) multicellular; both without fluctuations. The last-mentioned sub-division may be made to give high pressure.

M. Lemoult, Professor of Chemistry, Lille, has studied for the committee the compressed gas used by the Northern Railway of France. It takes the town's gas of Lille and compresses it to 20 atmospheres. In 1912 it used 9,553,000 cubic feet of gas, and collected 123.6 cubic feet of liquid hydrocarbons. The heating value was lowered from 568.6 to 544 B.T.U.'s per cubic foot, but about half the missing heat units were recoverable from the condensates.

As to the extensions of the use of pressure gas in Paris, the company have been developing the use of clockwork automatic lighters and extinguishers. There are now three compressing stations, but there will be several others as large extension of high pressure street lighting is contemplated for next year. At present the number of high pressure lamps is 1,405 (16 of 500 candles, 239 of 1,000, 984 of 2,000, and 166 of 4,000). Of these, the 500 candle lamps are all Welsbach (French Welsbach Company); the 1,000 candle, 90 Pharos and 149 Welsbach; the 2,000,500 Graetzin, 14 Auer Colonia, 91 Pharos, 336 Welsbach, 31 Pintsch, 12 Keith; and the 4,000 candles, 103 Graetzin, 2 Auer Colonia, 35 Pharos, 23 Welsbach, and 3 Keith.

## The Large Quantity Measurement of Artificial Gases in Distribution Systems.[1]

[Read before the Thirteenth Annual Convention, Wisconsin Gas Association, by J. C. Wilson.]

It is the purpose of this paper to outline briefly a few problems in gas measurement that have resulted from recent progress of the industry, to describe a method of measurement developed within our own State during the past few years, and to discuss the general characteristics of this method in so far as it applies to the problems outlined. In order to make clear the exact requirements of these new types of service and the methods of meeting them, a little space has been given to a discussion of the standard unit in which artificial gases are measured.

*Measuring Stations in a Gas Distribution System.*—Fig. 1 is a

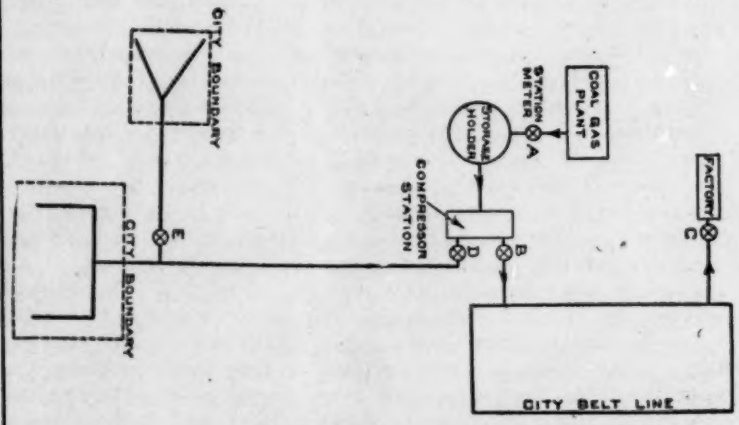


Fig. 1.

diagrammatic representation of a distribution system for gas manufactured in a plant located in a medium sized city, and consumed in that city and two others of smaller size. The imaginary system here outlined is somewhat similar to that now being operated with the city of Racine as a base and supplying also Kenosha several miles distant, and some outlying towns.

The measurement of the gas at *A* by the station meter as it is made into the storage holder has been general practice for so long that it needs little description. The wet displacement meter, with correction tables for pressure and temperature, has furnished a quite reliable but very costly means of measuring total gas made; but gives but little other information. If the observations are taken very accurately each hour and the results carefully corrected for temperature and pressure and then plotted graphically, the slight variations from hour to hour and from day to day may be used for comparison of results obtained under different operative conditions, but beyond this possibility and the record of gas made during each 24 hours the results from the wet meter do not inspire an interest among plant operators in obtaining steady operation at maximum efficiency. The value of the station meter from this standpoint can be very greatly enhanced by employing a method of measurement which will give besides a totalized record of flow, a graphic chart of the rate of flow directly in standard units. An illustration of the advantages of such a method will be shown later.

1. Slightly abridged.—Eds.

Measurement at *B* is not so well known, and to the writer's knowledge it is being done in only a few instances. Because of the many advantages to be derived from it, however, the value of this measurement is coming to be appreciated by progressive engineers and probably only the inability to accomplish it successfully and economically heretofore has prevented its general use. Measurement at the point *B* is quite distinct from that at *A* in that it shows the widely varying rate of sendout from the storage holders instead of the rate at which it is made into the holders. A graphic and totalized record of flow past this point shows not only the total daily demand for gas but also the exact nature of this demand on the plant and storage system every moment of the day. The tendency toward distribution at high pressure, and the use of booster stations during the peak loads makes the possibility of satisfactory measurement at this point all the more interesting.

*C* is a measuring station in a line supplying a large manufacturing plant. Until a very few years ago the measurement of gas supplied to large individual consumers was not an important problem. Such progress has been made in the use of gas for industrial purposes that the nature of the demand from a few large manufacturers may be an important feature in the operation of a whole system, and the income therefrom may be an appreciable percentage of a gas company's total income. Moreover the manufacturer's monthly or annual gas bill may be one of his important items of expense. In such a case a graphic as well as a totalized record of the demand for gas will help to bring about its efficient use and the greatest possible satisfaction to the consumer.

The manufacture of gases in large quantities in centralized coal and coke oven plants and its distribution to distant cities under high pressure through lines of comparatively small diameter is coming into use very rapidly. This tendency is entirely in accord with the corresponding trend in the electrical industry toward the generation of energy in large stations and its distribution to distant points at high pressure. This change has involved many new developments in high pressure lines, compressor stations, etc., and the measurement of high pressure gas in the trunk lines presents a new problem. Heretofore the problems in artificial gas measurement have been confined to pressures not exceeding a few inches of water. To-day we must be able to measure gases at any pressure up to 100 pounds and at widely varying rates of flow. The difference between these requirements is so great that the old basic principles and methods do not give the desired results. The measuring stations indicated at *D* and *E* are typical locations of meters in a high pressure system.

Before entering upon further discussion of these measurement requirements it will not be amiss to discuss briefly the unit of measurement in artificial gas work. Under the trend of conditions above outlined the distribution engineer finds that he is dealing with gases under conditions of temperature and pressure, especially the latter, differing more and more from standard conditions. This makes important a clear conception of what the standard unit is, and of the methods employed to reduce measurement results to this unit for purposes of accounting and comparison.

Fig. 2 represents graphically the standard unit of artificial gas and shows the specifications for it generally accepted. The standard unit of gas measurement (which corresponds to the watthour in the electrical industry) is one cubic foot of gas at a pressure of 30 inches of mercury absolute, having a temperature of 60° F., and just saturated, that is, it contains all the water vapor that it can hold at 60°. But the actual pressure and temperature of the gas seldom correspond to these standard conditions at the points at which it must be measured. Let us consider what effect the existing conditions in a line may have on the space which this standard unit occupies. Fig. 3 shows the space which this standard unit (Fig. 2) will occupy if its temperature is increased to 100° F. and if it is allowed to absorb the additional water vapor which it will hold at this temperature. In accordance with Charles' law the cubic foot of gas will increase its volume in proportion to the increase in absolute temperature; in accord with the laws of the vapor tensions of gases it will increase its volume an additional amount because of the additional amount of water vapor it will hold at 100°.

Fig. 4 shows the space occupied by the original cubic foot caused by a change in pressure, the temperature remaining at 60° F. In this case in accordance with Boyle's law the volume decreases in inverse proportion to the absolute pressure.

The significance of these variations in the space occupied by the standard unit of gas when subjected to different conditions of temperature and pressure is evident when we consider that, until a short

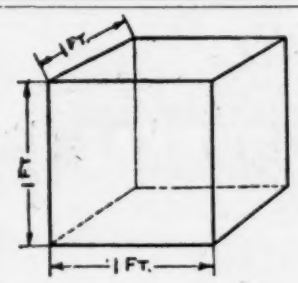


Fig. 2.

STANDARD UNIT OF ARTIFICIAL GAS
VOLUME = 1 CUBIC FOOT.
PRESSURE = 30" MERCURY ABSOLUTE
= 14.7 POUNDS ABSOLUTE
TEMPERATURE = 60° FAHRENHEIT.
SATURATION = 100 PER CENT
HEATING VALUE = 600 B.T.U. } VARY WITH
CANDLE POWER = 18 } LOCATION.

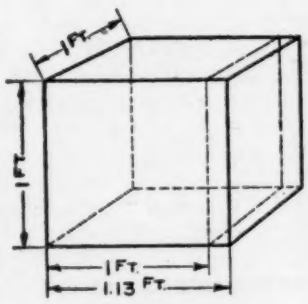


Fig. 3

SAME QUANTITY OF GAS AS SHOWN IN FIG. 2
PRESSURE = 30" MERCURY ABSOLUTE
TEMPERATURE = 100° F.
SATURATION = 100 PER CENT
CORRECTION FOR WET METER FROM U.G.I TABLE = .885.
VOLUME = 1 ÷ .885 = 1.13 CUBIC FEET.

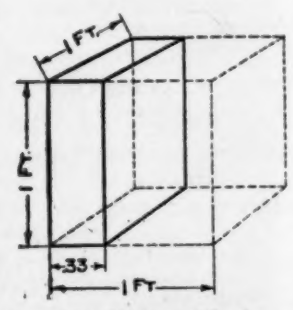


Fig. 4

SAME QUANTITY OF GAS AS SHOWN IN FIG 2
PRESSURE = 30 POUNDS GAUGE
TEMPERATURE = 60° F
SATURATION = 100 PER CENT
VOLUME = $\frac{14.7}{30 + 14.7}$ = 0.33 CU. FT.

time ago, all the methods available for the measurement of gas were based on volumetric principles; that is, all the meters available were based either upon volumetric displacement, or upon the measurement of velocity through passages of known area. Both of these methods are really volumetric, and results obtained by either of them must be reduced by correction tables or by calculations to standard units. Thus when the industry entered the field of high pressure distribution it had available for measurement only methods based on "space occupied" which is the most variable of all the physical properties of high pressure gases, and there arose the necessity for the development of some new measurement method. It was desirable that the basis for this new method be some physical property of the gas which remains as nearly constant as possible under all working conditions of pressure, temperature and composition.

*The Heat Method of Measurement.*—While experimenting with the heating of flowing gases through known temperature ranges in the engineering laboratories of the University of Wisconsin, Professor C. C. Thomas found that, for a given industrial gas, it always takes almost exactly the same quantity of heat to raise the temperature of a cubic foot through a fixed range. If we define the specific heat of a cubic foot of gas as the number of B. T. U.'s required to raise the temperature of one standard cubic foot 1° F., then it may be said that Professor Thomas' experiments established that this specific heat value is almost a constant, with the variations in composition ordinarily found in practice.

At first thought this does not seem quite reasonable because of the widely varying composition of manufactured gases from day to day, with differing fuel and plant operation, etc. Further investigation showed that this peculiar conditiom was due to the fact that the specific heat values for the various constituents of these gases per unit volume under given temperature and pressure conditions are quite nearly the same. So long as this is true and so long as the same general characteristics obtain in the gas the specific heat per cubic foot of the mixture of these gases must remain nearly the same. Although the specific heat values of the illuminants are somewhat higher than those of the other constituents these gases are present in comparatively small quantities and a variation in their amount has but little effect upon the total specific heat value. Moreover the regulation of the relative amounts of these illuminants and the remaining constituents of the gas for the maintenance of a constant heating value also tends to keep the specific heat constant. In his paper on "Recent Developments in Gas Measuring Apparatus,"

(*Continued on page* 58.)

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NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, JULY 27, 1914.

[Official Notice.]

## New Jersey State Gas Association.

Office of the Secretary,
Broad and Bank streets, Newark, N. J.,
July 21, 1914.

The next meeting of the New Jersey State Gas Association will be held at Wardell's, Port-au-Peck, on Pleasure Bay, Wednesday, Aug. 12, 1914. The meeting will convene at 10 A.M., and the following papers will be read and discussed:

"Development and Possibilities of Gas Water Heating," by Mr. Herbert Long, of Long-Landreth Company, New Brunswick, N. J.

"Newest Things in Gas Lighting," by Mr. F. N. Hamerstrom, of the Welsbach Company, Gloucester, N. J., and Mr. J. P. Conroy, of the General Gas Light Company, New York city.

"Auxiliary Heating," by Mr. William Schofield, of the Sanitary Heating Company, Brooklyn, N. Y.

The session will continue until 2 P.M., at which time a clam bake will be served. This "Bake" is an annual event of the New Jersey State Gas Association, and the chef preparing it is famous throughout this part of the country.

Is is expected that every member of the Association will be present and that many guests will also enjoy the hospitality of the Association.

Wardell's can be reached via. P. R. R. or C. R. R. of N. J., to Long Branch, thence by trolley to Pleasure Bay.

O. F. Potter, Secy.

[Official Notice.]

## Michigan Gas Association Meeting.

Office of the Secretary-Treasurer,
Grand Rapids, Mich., June 29, 1914.

The annual meeting of the Michigan Gas Association will be held at Lake Harbor, Wednesday, Thursday and Friday, September 2, 3 and 4. This decision has just been made by the Executive Committee of the Association and we are sure those attending the meeting will find this departure from the regular practice of holding gas association meetings in the large cities, a most delightful experience.

Lake Harbor is a resort beautifully located on Lake Michigan and an inland lake 4 miles south of Muskegon, Mich. It is reached by Goodrich Boat Line via Muskegon, and by the Grand Rapids and Indiana Railway, and the Grand Rapids-Muskegon Electric Road via Grand Rapids. The hotel accommodates 500 guests, is prettily located and gives excellent service. There is a fine 18 hole golf course, baseball grounds, 9 tennis courts, Lake Michigan bathing beach, fine bath houses, bowling alley, billiards, canoeing and good automobile roads. There is a combination theater and convention hall which may be used for dancing parties as well as for the business sessions of the convention.

There are a number of cottages in connection with the hotel, and it is hoped that members will bring their wives and children, for the resort specially caters to the whole family.

At the time chosen, the association will have the resort practically to itself, and there is enough to do aside from a carefully planned business programme, which will be announced later, to make the trip worth while to any gas man within reachable distance of Michigan. Every gas man is invited to meet with us whether a member of the association or not. The hotel rates are on the American plan ranging from $3 a day without bath, to $4 and $5 a day with bath; and will for this occasion cover the use of the golf course, tennis courts and other features for which there is usually an additional charge. Glenn R. Chamberlain, Secy. Treas.

[Special Correspondence.]

## German Gas Exposition and Meeting of German Society of Gas Engineers.

Precisely at 4 P.M., June 30th, 1914, the German Gas Exposition was opened at Munich.

It was originally planned to have King Ludwig 3rd, of Bavaria, open this great exposition, but he was unable to attend and, therefore, Minister President Count Hertling opened the exposition in his stead.

Owing to the great number of the various appliances, gas machines, etc., it was impossible to get the full exhibit in one hall, and the exposition will be described in sections.

*Hall No.* 1.—The decorations here are white and green. One of the most attractive exhibits was the small models of the gas works of Nurenberg and of Leopoldau-Wien. To give some idea of the capacity of this Nurenberg plant, their daily make is 140,000 cubic meters. Never before in the history of German gas industry have models of this kind been attempted with such success. Each one of the models was complete in every detail, even to the gas holder, which has a capacity of 150,000 cubic meters; and the station meter, etc., all complete. Among the things that attracted attention in the Leopoldau-Wien was the miniature Koppers Chamber Oven complete, and showing a section where the coal had been carbonized but still intact in the oven. Amongst other models was a large inclined bench installation complete with coal and coke handling apparatus. There was a most complete exhibit of condensers, washers, scrubbers, purifiers, etc., in fact all kinds of gas generating apparatus was on view. In some booths were stereoptican views of some of the modern plants in Europe; and in one photographs of the largest gas holders on the continent, those at Brigittenau.

This entire hall was filled with exhibits of machinery, but some mention should also be made of the exhibit by the different coal companies. Some very interesting figures and data was given by them, amongst which was "That the combined gas plants consumption in Germany per minute is in round figures 15 tons of coal." Figures of this kind opened the eyes of the average layman who visited this wonderful exhibit.

*The Casino.*—This hall was made a blaze of light by the firm of Julius Pintsch, who showed their entire process, together with a large number of moving picture films giving the process of manufacturing gas, the course of the coal from the mines to the works, and methods of transportation, etc. There were also a number of exhibits pertaining to the "Safety First Movement," now so potent, each one well illustrated by photographs, films, etc.

*The Pavilion.*—Here among the many exhibits was a most interesting one by The Dessau Vertical Oven Company, of Berlin, showing all kinds of models and even full sized installations of gas apparatus. The subject of hygiene of gas was also illustrated. The display of the different methods of gas street lighting was wonderful. High pressure lighting, especially district and works control for lighting and extinguishing was well represented.

*Pavilion No.* 2.—Among the many models of miniature gas plants we must also mention the models and panoramic views of the gas plants at Savilla and Manilla.

*Hall No.* 2.—In this hall was the exhibit of gas meters, and special attention was paid to 10 pfennig prepayment meters. There was also a large array of gas mantles, together with exhibits by the different pipe manufacturers. In addition a large number of distance lighters for house and commercial use were displayed and demonstrated. This exhibit attracted a great deal of attention.

*Hall No.* 3.—A most excellent and interesting exhibit was held here of the chemical end of the gas business, and of the distillation of the various residuals and the saleable commodities derived therefrom.

*Hall No.* 4.—This hall was devoted to exhibiting gas appliances, including stoves, lamps, etc. This hall was also used for demonstrations of all kinds, making a most interesting exhibit not only to the house wife and the manufacturer, but to the architect as well.

*Halls Nos.* 5 *and* 6.—These halls were used for the display of industrial appliances of all kinds. At the entrance was a complete candy company outfit, including furnaces, batch heaters, etc., all in operation. Then came a complete gas laundry, and a complete line of jewelery manufacturers appliances all in full blast and actual operation; then those for the butcher and packer. All these displaying to the manufacturer, as well as to the layman the use of gas for industrial purposes in its many phases. Amongst the other gas industrial displays was a complete glass plant in operation. Together with these were metal furnaces, of every size and description all connected up and shown in operation.

In hall No. 6 were the displays of acetylene, blau gas and natural gas outfits. Among the most interesting were the field installations for manufacturing gas for ballons and cooking in the field, including a complete bake shop for army purposes. There were also a number of special ovens, furnaces, etc., made to burn gas, and built especially for army and navy use.

Beginning at the same time as the exhibition, the annual meeting of the German Society of Gas and Water Engineers was being held, there being nearly 1,500 men attending this, the 55th Annual Convention of the Association. A banquet was held the opening night, at which the address of greeting was made by Register Panzer on behalf of the city, while his address was answered for the gas men by Engineer Reese, of Dortmund.

## BRIEFLY TOLD.

INDUSTRIAL FUEL SESSIONS AT MINNEAPOLIS MEETING, NATIONAL COMMERCIAL GAS ASSOCIATION.—The N. C. G. A. feels that this work is of such importance that every industrial man should be present at the Minneapolis meeting in December. Every gas company is urged to co-operate to the utmost to extend the industrial fuel end of the business. Remember that the industrial fuel business has not only "a future," but a present and ever-pressing value to every gas man. The industries need education in this important sphere, and in order that they may receive this education, the gas company heads and the gas salesman must be educated both in gas operations and in those industries in which the gas can play so important a part. Many members have private memorandum books in which they make records of industrial fuel data. These, if brought to the meetings, will be of the utmost value; and from all each member will get something, and he will doubtless give what he already has. Every member should, therefore, be present. The officers of the Association will be glad to meet him, and seek the opportunity to be of assistance to him. The following is the programme as at present arranged:

GENERAL.

I. Commercial and Engineering.
II. Food Stuffs Industries.
III. Metallurgical and Miscellaneous Industries.

A paper on:

I. (*a*) The Best Method to Secure Industrial Business.
(*b*) Maintenance and Supervision.
(*c*) Advertising.

II. 1—*Hotel and Restaurant Equipment.*
(*a*) Hotel and Restaurant Ranges.
(*b*) Hotel and Restaurant Boilers.
(*c*) Hotel and Restaurant Ovens.
(*d*) Hotel and Restaurant Miscellaneous Appliances.
2—*Candy Furnaces and Candy Manufacturing Equipment.*
(*a*) Bakery Equipment.
(*b*) Portable Hot-Air Ovens.
(*c*) Rotary ovens.
(*d*) Dutch Ovens Changed to Gas.
(*e*) Miscellaneous Appliances.
3—*Butcher and Packing House Equipment.*
(*a*) Cauldrons.
(*b*) Smoke Houses.
(*c*) Manufacturing Wholesale Grocers Equipment and Miscellaneous Appliances.
4—*Gas in Breweries.*
5—*Gas for Coffee and Peanut Roasting.*

III. 1—*Metallurgical.*
(*a*) Melting—1. Soft metals.
2. Aluminum.
3. Brass and Copper.
(*b*) Carbona Process.
The Sheradizing Process.
(*c*) The Steam Boiler.
Capacities, Efficiencies and Work.
2—*Engineering.*
(*a*) Burners—1. Luminous.
2. Atmospheric—Bunsen.
3. Blast—Bunsen.
4. Surface Combustion.
(*b*) Factor of Efficiency.
(*c*) Flame Temperatures.

There can be no doubt but that the industrial fuel sessions will be one of the most interesting features ever brought before the gas man. The Mid-Year Conference saw the commencement of this work, and the Minneapolis Convention will find it broadened to a marked degree. Every member who is qualified to do so is invited to co-operate with the Committee in particular, and with the Association, by criticising the programme outlined. Suggestions will be welcomed and should be sent in as soon as possible. Moreover, any member who has had experience along the lines indicated is asked to prepare a paper covering a distinct operation in which success has been achieved (not the whole process). Papers should not exceed 1,000 words in length. We repeat that every industrial fuel man should be present at Minneapolis. All your industrial fuel problems should be brought to Minneapolis. If you do not go you will miss one of the most important events in gas history. If you do go you will never regret it.

DISTRIBUTING THE BOOKLET "GAS EQUIPMENT OF THE HOME."—The proper circulation of the booklet "Gas Equipment of the Home," is being given consideration by some of the live gas companies. A special campaign was considered at a joint meeting of representatives of a company in one large city with those of four companies operating in the suburban towns within 100 miles. These gentlemen had been studying a plan for using the booklet and obtaining from it the best possible educational value. They found that the architects in the city practically covered the area within 100 miles, and that the distribution to them should properly be divided between the companies, as all would benefit; and it was decided that the distribution should be made jointly. Leather bound copies were to go to the architects of the city, editors of newspapers, libraries, city officials, and members of State commissions; and to have the name of the recipient stamped on back of the cover. Canvas bound copies were to be placed in the hands of the companies' salesmen and office employees, stove and appliance dealers, and building contractors. Paper bound copies were to be given to plumbers, gas consumers who contemplate building homes, and to a special list of about 5,000 of the wealthier class. The leather bound copies are to have inserted next the fly leaf a post card that may be detached and returned acknowledging receipt of the booklet, and the stub end of the card remaining permanently in the booklet is to have printed on it "Compliments of your gas company."

This large company is recognized as in the front rank as a believer in publicity and the use of large scale advertising. It immediately saw the value of this booklet and has ordered 6,000 copies in the various bindings. In addition to the distribution plan outlined it is making a list of 5,000 residents of its territory to whom complimentary copies will be sent in a general campaign of education on the use of gas in the home.

Evidently other progressive companies have similar plans as orders for 2,000, 3,000, and in one case for 7,500 copies have been received by the Association; and as the first edition is about exhausted a second edition has been ordered and is now on the presses. Suggestions for distributing will be of value to other companies, and the Home Equipment Committee ask that you write to Mr. Louis Stotz, Secretary, No. 29 W. 39th street, New York, giving any ideas that you think will be helpful to companies that may be considering the matter.

There have been inquiries for the booklet in a smaller size for for general distribution, and the Committee has decided to issue an edition, size 6 inches by 8, with some minor changes and additions. This edition will be in the same quality paper and cover as the original booklet, and will be ready for delivery about August 1st at the following prices:

| | |
|---|---|
| One to 100 copies, each | 10 cents. |
| Next 900 copies, each | 8 " |
| Copies in excess of 1,000, each | 7½ " |

The full sized booklet is priced thus:

| | Leather. | Canvas. | Paper. |
|---|---|---|---|
| One to 100 copies, each | $1.00 | 50 cents. | 25 cents. |
| Next 900 copies, each | .95 | 45 " | 20 " |
| Copies in excess of 1,000 each | .90 | 40 " | 15 " |

Orders should be sent to Mr. Louis Stotz, Secretary, 29 West 39th street, New York city.

(Continued from page 55.)

presented at the 1912 meeting of the American Gas Institute. Professor Thomas illustrated with a variety of gases the constancy of the value of specific heat with varying composition and showed that the specific heat of water gas varies by only a very small percentage from that of coal gas, in spite of their widely different analyses. In accordance with the laws of physics the specific heat value of the standard cubic foot remains almost constant when the cubic foot of gas is compressed to a higher pressure and smaller volume. This means that if a standard unit of gas (Fig. 2) is compressed to one-third its original volume (Fig. 4) it still takes the same number of B.T.U.'s to raise its temperature one degree F.

Similarly the specific heat value for the standard cubic foot remains practically constant when the cubic foot is raised to a higher temperature and thus caused to increase its volume; or when its temperature is decreased and its volume correspondingly decreased. In other words it takes the same number of B.T.U.'s to raise the temperature of a standard unit quantity of gas from 100 to 101° as it does to raise its temperature from 60 to 61°.

One exception to this statement must be made in the case of high temperature manufactured gases at low pressure. As such gases increase in temperature above 60° they will hold an additional quantity of water vapor over the quantity they will hold at the standard temperature, and they will absorb this additional amount if brought into immediate contact with water. This, of course, increases the value of the specific heat by a small amount. The method of compensating for this small variation in the specific heat value of the standard unit is described in a later paragraph. From a common sense standpoint it is entirely reasonable to believe that this specific heat value of the standard cubic foot does not change when the gas is compressed to a smaller volume or expanded by temperature to a larger volume, because there still remains the same amount of "stuff" as the original cubic foot contained and it should therefore require the same amount of heat to raise its temperature 1°. The discovery that this physical property of industrial gases remains constant within commercial limits through all the variations in composition, temperature, and pressure led to the development of a method of measurement based on the specific heat value of the standard cubic foot of gas. It seemed evident that if heat could be applied to a flowing gas to produce a known constant temperature rise in that gas, and if the quantity of this heat could be measured, its measure would constitute a measure of the quantity of gas flowing. Professor Thomas had already learned that a good way to raise the temperature of a flowing gas through a small range was by means of electrical energy, because it can so easily be converted into heat, so easily controlled, and so easily measured. The following equation forms the basis of his method:

$$\frac{\text{Cubic feet} \times \text{specific heat} \times \text{temperature rise}}{3.415} = \text{Watthours in which}$$

| | |
|---|---|
| Cubic feet | = The number of standard cubic feet of gas at 30 – 60 flowing per hour. |
| Specific heat | = B.T.U.'s required to rise 1 standard cubic foot of gas 1° F. |
| Temperature rise | = The temperature rise in degrees F. produced in the gas by the heat supplied. |
| Watthours | = Number of watthours of electrical energy in the form of heat required to bring about the given temperature rise. |
| 3.415 | = The B.T.U. equivalent of 1 watthour. |

From this equation it is apparent that if the temperature rise in the gas is maintained constant and if the specific heat of the standard cubic foot remains constant within practical limits, as we have shown it to be, the number of watthours required to bring about the constantant temperature rise will be a direct measure of the gas flowing —not of the number of actual cubic feet flowing through the meter, but of the number of standard units of gas passing regardless of its temperature and pressure. This method of measurement and the meter developed from it bear Professor Thomas' name, but because of the electrical features involved it is often termed the Electric Meter. Since the meter has been developed into working form and the method of measurement subjected to the final test of service, the theoretical conclusions regarding the constancy of the specific heat value with variations in composition, pressure and temperature, have been proven beyond a doubt.

The way in which the basic equation has been developed into a commercial meter is described in Professor Thomas' paper previously referred to. The apparatus may be briefly described thus:

The meter consists essentially of two parts; a heating system by which a measured amount of heat is dissipated into the gas from an electrical resistance heating unit; and a temperature control system by which the amount of this heat is so regulated that the temperature rise in the gas is just 2° F. The heating unit (see Fig. 5) has in

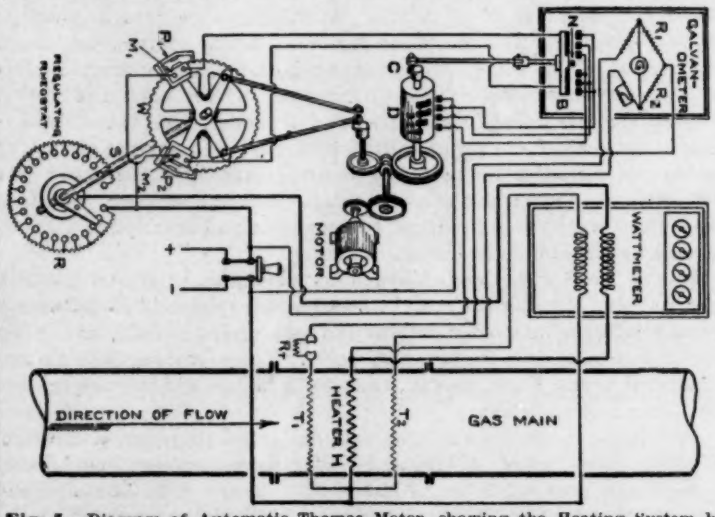


**Fig. 5.**—Diagram of Automatic Thomas Meter, showing the Heating System by which a Measured amount of Heat is Dissipated into the Gas and the Temperature Control System by which this heat is so Regulated to Maintain a Constant Rise of Temperature in the Gas.

series with it a regulating rheostat by which the electrical energy supplied to it may be increased or decreased. Above and below this heating unit are the thermometer units $T_1$ and $T_2$ which form two arms of a Wheatstone bridge, the fixed resistance $R_1$ and $R_2$ forming the other two arms. A galvanometer $G$ is connected across the bridge, the end of its needle shown at $N$. The thermometer units $T_1$ and $T_2$ are resistance units of nickel wire, which increase their resistance with increase in temperature. These units have exactly the same resistance when at the same temperature and any variation in their relative temperatures will cause an unbalancing of the bridge and a deflection of the galvanometer needle. After this bridge is exactly balanced a resistance $R$ known as the temperature resistance, is inserted in series with $T_1$. This resistance has such a value that $T_2$ will equal the sum of $T_1$ and $R$ when its temperature is exactly 2° higher than that of $T_1$. Current is now passed through the heater unit and the deflections of the galvanometer needle to the right or left cause this heater energy to be increased or decreased until it is of just the correct amount to bring about a rise of 2° in the gas. The needle is enabled to accomplish this regulation by being periodically clamped between selective contacts, thus energizing the magnet $M_1$ or $M_2$, engaging the pawl $P_1$ or $P_2$ with the toothed wheel $W$, and moving the rheostat $R$ which in turn decreases or increases the heater energy. A small continuous running motor supplies to the pawls the power to move the regulating rheostat. The electrical energy required to bring about this temperature rise is measured on a watthour meter and on a recording wattmeter. The dials and scales of these wattmeters are calibrated in cubic feet of gas instead of in electrical units and results are shown directly in standard cubic feet without any corrections for pressure and temperature variations. The apparatus as built naturally divides itself into two general parts, the housing in the pipe line containing the measuring units, and the recording panel on which are mounted the mechanism of the automatic control and the measuring instruments. Electric wires in conduits connect the two parts, which may be located at almost any distance from each other. Two types of the housing are shown in Figs. 6 and 7 and a recording panel in Fig. 8. When desired the recording panel having mounted on it only the measuring instruments and control switches is separated from the moter driven control mechanism and placed in a convenient location in or near the operating superintendent's office. Figs. 9 and 10 show the heater and thermometer units respectively.

Professor Thomas did not describe the compensation method employed to provide against error from the increase in specific heat of the standard unit due to the added amount of water vapor which artificial gases absorb at high temperature, and it may be well to touch briefly upon this detail here. The percentage variation in specific heat of the standard cubic foot due to this additional water vapor content is approximately one-half the corresponding variation in volume for the same change in temperature. It is also a direct function of the temperature of the gas, since such gases are assumed

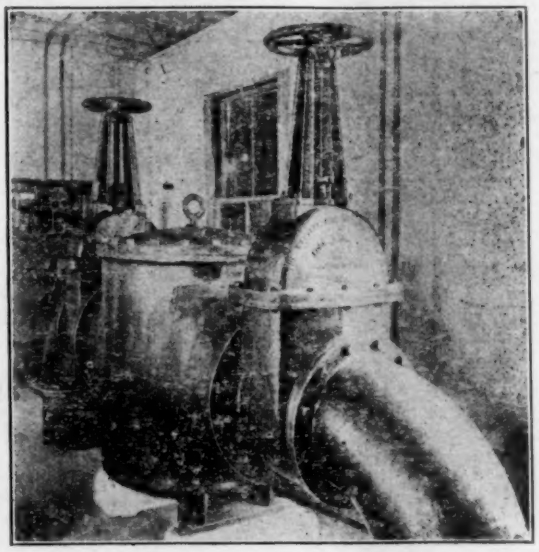

**Fig. 6.**—A Thomas meter installation of 150 000 cubic feet per hour capacity, showing the horizontal type of housing.

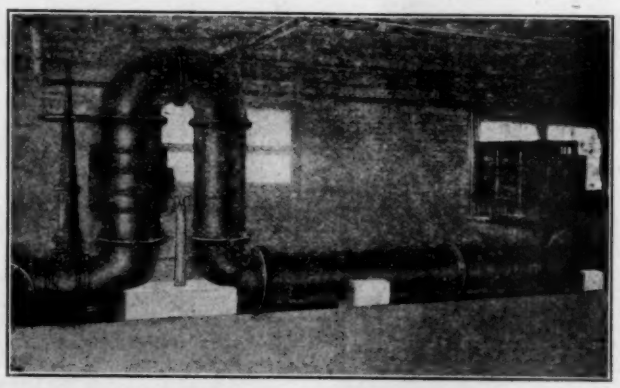

**Fig. 7**—Installation showing the vertical type of housing, regulating rheostat at the right. This meter measures surplus gas from a coke oven plant and has a maximum capacity of 400,000 cubic feet per hour.

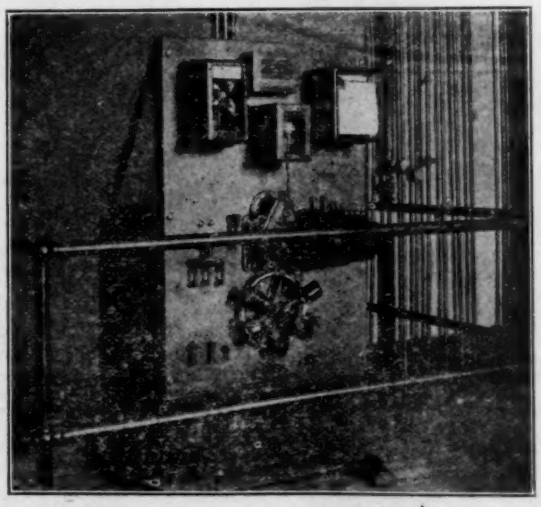

**Fig. 8.**

to be just saturated. It is evident from a glance at the basic equation for this meter that this increase in specific heat value will be compensated for if the temperature rise in the gas brought about by the meter is correspondingly decreased. When such high temperature gases are to be measured the temperature difference coil in the meter, the resistance value of which determines the amount of the temperature rise, is located in the flowing gas and is made of such material that its resistance decreases at the desired rate with increase in temperature. Thus the temperature rise in the gas and the variation in the specific heat of the standard unit become similar, but opposite functions of the same temperature variation and can be designed to compensate very accurately.

The accuracy of the meter in the measurement of coal gas and water gas, and particularly of its ability to compensate for the water

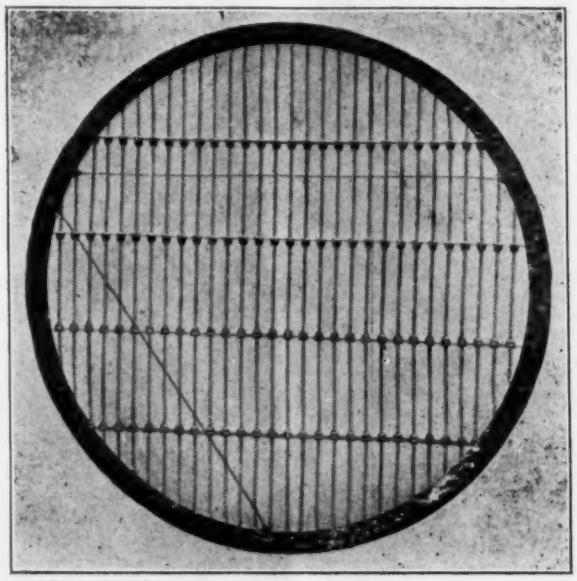

**Fig. 9.**—Heating unit. Electric energy supplied to the evenly distributed resistance wire is converted into heat, and the heat dissipated into the flowing gas to cause a fixed temperature rise.

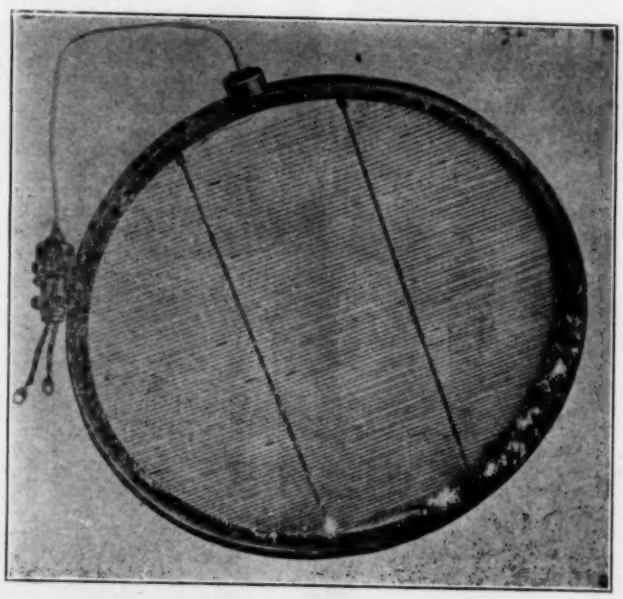

**Fig. 10.**—One of the two resistance thermometer units This unit consists of a continuous length of insulated and armored nickel wire which increases its resistance with an increase in temperature.

vapor content in low pressure high temperature gases, is shown in Tables 1 and 2; summaries of very careful tests made at Station A

TABLE 1. SUMMARY OF FIVE TESTS OF THOMAS METER AGAINST WET METER ON COAL GAS DETROIT CITY GAS CO STATION A AUG 30-31 AND SEPT 1-1913

| NO. OF TEST | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| TEST BEGINS | 10 A.M. AUG. 30 | 7 P.M. AUG. 30 | 1 P.M. AUG. 31 | 10 P.M. AUG. 31 | 9 A.M. SEPT. 1 |
| TEST ENDED | 6 P.M. AUG. 30 | 8 A.M. AUG. 31 | 3 P.M. AUG. 31 | 8 A.M. SEPT. 1 | 12 P.M. SEPT. 1 |
| CUBIC FEET BY WET METER, UNCORRECTED | 1,111,700 | 1,737,800 | 1,071,500 | 1,238,800 | 504,400 |
| AVERAGE TEMPERATURE OF INLET, DEGREES FAHRENHEIT | 68.9 | 67.2 | 67.72 | 66.99 | 68.2 |
| " " " OUTLET, " " | 65.0 | 64.2 | 64.05 | 64.01 | 66.1 |
| " " " GAS IN METER " " | 64.9 | 65.7 | 66.13 | 65.48 | 67.15 |
| AVERAGE PRESSURE OF INLET, INCHES OF WATER | 9.24 | 10.76 | 11.27 | 12.56 | 12.64 |
| " " " OUTLET " " " | 8.23 | 9.87 | 10.20 | 11.56 | 11.58 |
| " " GAS IN METER | 9.45 | 10.82 | 10.72 | 12.36 | 12.11 |
| AVERAGE BAROMETER | 29.84 | 29.44 | 29.46 | 29.58 | 29.46 |
| " CORRECTION FACTOR FROM U.S.I. TABLES | .9278 | .9260 | .9350 | .9478 | .9447 |
| CUBIC FEET OF GAS BY WET METER, CORRECTED | 1,031,101 | 1,609,145 | 1,002,777 | 1,192,443 | 476,449 |
| THOMAS METER, AVERAGE TEMPERATURE OF INLET, DEGREES FAHRENHEIT | 63.7 | 63.0 | 63.3 | 64.0 | 64.0 |
| TOTAL CUBIC FEET BY THOMAS METER | 1,031,800 | 1,629,300 | 1,010,200 | 1,201,800 | 478,600 |
| PERCENTAGE DIFFERENCE IN RESULTS FROM THE TWO METERS | 0.04 | 0.7 | 0.3 | 0.8 | 0.4 |

of the Detroit City Gas Company on coal gas against a new wet meter, and on water gas against an enclosed holder. These tests were made against a brick enclosed holder which offered splendid opportunities for accurate tests since the temperature of the water and of the surrounding atmosphere could be closely regulated. The Thomas meter has been checked against all other reliable methods in the measurement of nearly all industrial gases and also quite extensively in the measurement of air.

The principal features of the Thomas meter which make it specially adaptable to the measurement of gases in distribution systems may be briefly outlined as follows:

1. The ability to give results in standard units of gas at 30—60 saturated, regardless of the actual temperature of pressure of the gas flowing through it or their variations.

2. The very wide range in rate of flow through which accurate measurement is possible.

3. The ability to trace variations in flow on a graphic chart.

4. The low cost at which widely varying rates of flow can be measured.

5. The lack of necessity for daily inspection and care and facilities for periodic inspection and checking of those features which can affect the accuracy.

TABLE 2. SUMMARY OF SEVEN TESTS OF THOMAS METER AGAINST HOLDER ON WATER GAS.
DETROIT CITY GAS CO. STATION A SEPT. 8-9-10-11-12 & 13-1913.

| NO. OF TEST | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| DATE | SEPT 8-9 | SEPT 9-10 | SEPT 9-10 | SEPT 10-11 | SEPT 11-12 | SEPT 12-13 | SEPT 12-13 |
| TIME BEGUN FILLING HOLDER | 11:28 A.M. | 7:37 P.M. | 11:42 P.M. | 10:25 A.M. | 8:35 A.M. | 11:30 A.M. | 6:36 A.M. |
| " FINISHED | 2:18 P.M. | 9:07 P.M. | 2:45 P.M. | 12:00 A.M. | 10:40 A.M. | 1:04 P.M. | 11:00 A.M. |
| TIME HOLDER WAS ALLOWED TO SETTLE AFTER FILLING | 2HR-12M | 1HR-29M | 2HR-15M | 1HR-0M | 2HR-40M | 2HR-30M | 1HR-32M |
| INITIAL READINGS, HOLDER POSITION, SHEETS AND RIVETS | 0-22.5 | 0-22.5 | 0-21½ | 0-24.5 | 1-3 | 1-16 | 1-16.5 |
| CONTENTS, CU. FT., UNCORRECTED | 23,903 | 25,090 | 23,124 | 27,630 | 24,804 | 96,976 | 93,600 |
| TEMPERATURE OF WATER IN HOLDER, DEGREES FAHRENHEIT | 68 | 69 | 68 | 66 | 65 | 64 | 63 |
| TEMPERATURE OF AIR SURROUNDING HOLDER | 78 | 66.5 | 68.3 | 67.5 | 67.5 | 65.5 | 68.5 |
| TEMPERATURE OF GAS IN HOLDER, ESTIMATED | 71 | 67½ | 67.5 | 66.7 | 65.7 | 64.75 | 65.75 |
| PRESSURE OF GAS IN HOLDER, INCHES OF WATER | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 4.0 | 3.6 |
| BAROMETER | 29.05 | 29.07 | 29.05 | 29.06 | 29.05 | 29.76 | 29.46 |
| CORRECTION FACTOR | .9628 | .9720 | .9639 | .9697 | .9651 | .9801 | .9698 |
| CONTENTS IN CUBIC FEET, CORRECTED | 23,021 | 24,390 | 24,695 | 27,063 | 24,234 | 44,339 | 43,344 |
| FINAL READINGS, HOLDER POSITION, SHEETS AND RIVETS | 10-25 | 0-19 | 0-23 | 0-23 | 0-10 | 0-33 | 0-23.5 |
| CONTENTS IN CU. FT., UNCORRECTED | 237,107 | 239,287 | 243,694 | 243,494 | 237,286 | 240,798 | 240,450 |
| TEMPERATURE OF WATER IN HOLDER | 68 | 69 | 64 | 66 | 65 | 64 | 63 |
| TEMPERATURE OF AIR SURROUNDING HOLDER | 71 | 65 | 65 | 66 | 66 | 64.5 | 64 |
| TEMPERATURE OF GAS AS PASSED OUT, MEAN | 70.67 | 66.42 | 68.38 | 66.38 | 70.03 | 66 | 65 |
| PRESSURE OF GAS | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 4.0 | 4.0 |
| BAROMETER | 29.05 | 29.04 | 29.06 | 29.78 | 29.42 | 29.71 | 29.97 |
| CORRECTION FACTOR | .9689 | .9821 | .9840 | .9774 | .9689 | .9863 | .9861 |
| CONTENTS IN CUBIC FEET, CORRECTED | 249,111 | 234,960 | 240,340 | 237,980 | 228,892 | 238,195 | 241,699 |
| MEAN TEMPERATURE OF GAS PASSING THOMAS METER | 66.0 | 69.7 | 67.5 | 65.5 | 66.1 | 64.5 | 64.5 |
| " " " " ENTERING HOLDER | 69.5 | 67.0 | 67.7 | 65.7 | 71.0 | 66.5 | 67.0 |
| TOTAL CU. FT. BY HOLDER DURING TEST, CORRECTED | 224,090 | 205,585 | 217,053 | 210,886 | 194,606 | 194,404 | 198,455 |
| " " " " THOMAS METER | 223,990 | 204,760 | 216,980 | 210,700 | 194,800 | 194,000 | 198,300 |
| PERCENT ERROR IN THOMAS METER, BASED ON HOLDER | -0.4 | -1.9 | +0.5 | -0.1 | +0.2 | +0.2 | +0.06 |

Of these features the ability to give results directly in standard units even when the actual pressure and temperature of the gas passing the meter are varying through wide limits, is the most unique and simplest. The meter does this, not because of any corrective feature involved in its design, but because it depends for its operation upon a property of the gas which does not change appreciably with variations in pressure and temperature. A clear conception of this feature can best be obtained by viewing the whole measurement problem from the standpoint of present day requirements, and then considering the solution independently of the former volumetric methods and the corrections necessary to reduce results obtained by them to standard units. Its simplicity and directness can probably be best understood by a concrete example.

Table 3 shows the results of a 24-hour period of a test of long duration with a Thomas meter at Brave, Pa., in series with a very finely equipped Pitot tube station at Bula measuring high pressure natural gas. The second column shows the Thomas meter readings taken direct from the totalizing dial; the third column the standard cubic feet of gas which flowed through the meter during each 3 hour period (obtained directly by subtracting the dial reading at the beginning of the 3 hour period from that at the end). Note also that the pressure of the gas varied from 113 to 162 pounds during the 24 hours, and that the gas temperature differed considerably from standard. The results at the Pitot tube station were obtained by careful observations taken every 15 minutes and reduced to standard results by the use of the tables and constants derived from extensive calibrations.

TABLE 3.—*Noon April 26th to Noon April 27th*, 1911.

| Time. | Electric Meter Reading. | Cubic Feet Electric Meter. | Cubic Feet Pitot Tube. | Pressure Brave. | Pressure Bula. | Temp. Brave. | Temp. Bula. |
|---|---|---|---|---|---|---|---|
| 12.00 ... | 2498.0 | ..... | ..... | .. | ... | .. | .. |
| 3.00.... | 2603.6 | 1,056,000 | 1,056,539 | 134 | 140 | 47 | 46 |
| 6.00.... | 2714.3 | 1,107,000 | 1,115,176 | 157 | 161 | 47 | 43 |
| 9.00 ... | 2831.7 | 1,174,000 | 1,160,802 | 156 | 160 | 47 | 44 |
| 12.00 ... | 2965.0 | 1,333,000 | 1,311,671 | 162 | 167 | 47 | 43 |
| 3.00.... | 3086.7 | 1,217,000 | 1,226,774 | 162 | 166 | 47 | 42 |
| 6.00.... | 3215.0 | 1,283,000 | 1,310,577 | 114 | 124 | 47 | 40 |
| 9.00 ... | 3375 0 | 1,600,000 | 1,614,811 | 113 | 125 | 47 | 40 |
| 12.00 ... | 3523.2 | 1,482,000 | 1,480,000 | 135 | 143 | 47 | 46 |
| Totals..... | | 10,252,000 | 10,276,350 | | | | |

The range from maximum to minimum rate of accurate measurement with the Thomas meter is normally about 30 to 1, but it can be made considerably wider. This range corresponds quite closely to the range in rate of demand in a small city in which gas is used for the usual lighting and heating purposes. The meter is able to measure through this very wide range because of the wide range of accuracy in the watthour meter, and because the medium measured (the electrical energy supplied to the heater) is proportional to the rate of flow, and not to its square, as is the case with many meters.

The ability to obtain a graphic record of rate of flow in standard units is a most important feature and very valuable to an operator who has once formed the habit of using the information which can be obtained from it. The variations in rate of flow at points between the generating plant and the holder are usually small, but even here the irregularities which appear on the chart are of value in tracing irregular plant operation. The variations in flow beteen the storage holders and the consumers are of very considerable magnitude, and graphic charts of them are extremely interesting and their value,

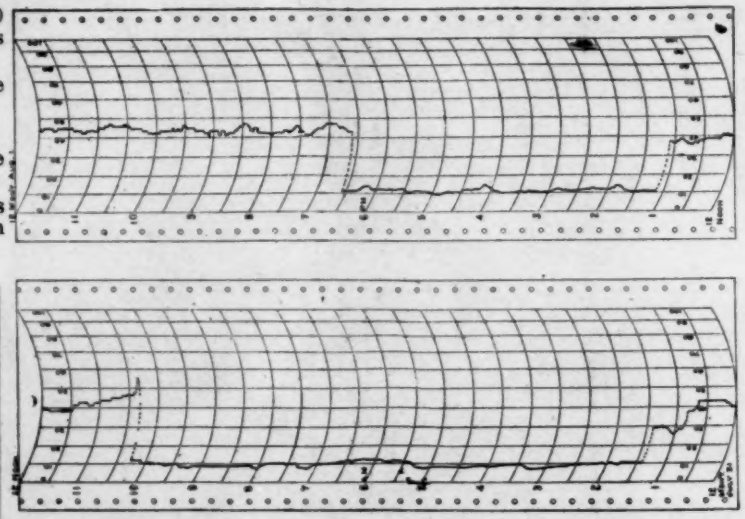



**Fig. 11.**—Chart from station meter in a small plant measuring coal gas only at a nearly constant rate during a portion of each day and a mixture of coal and water gas during the remainder of the day.

which is already coming to be appreciated, must increase with the growth of distribution systems.

Fig. 11 is a reproduction of a chart from a Thomas meter installed as a station meter in a combined coal and water gas plant. In this case coal gas was being made at a comparatively slow and steady rate through 24 hours of the day, and water gas was made at a faster rate for a few hours. The chart shows how the water gas system was operated, and also every irregularity in the operation of the coal gas plant, such as times of stoking, relative make of gas at beginning and end of stoking periods, etc. The intelligent use of a chart which shows immediately the net effects of any change in operation is a very material aid to the loyal employee who is anxious to better results, and it gives the superintendent an effective means of checking the work of less loyal men.

A graphic chart of the demand or sendout curve obtained by a meter at point *B* in Fig. 1 possesses a value to the operator which makes it almost indispensable when he has once realized that it can be obtained at a reasonable cost. It shows him the exact nature of the demand which his whole system must meet. Fig. 12 shows such

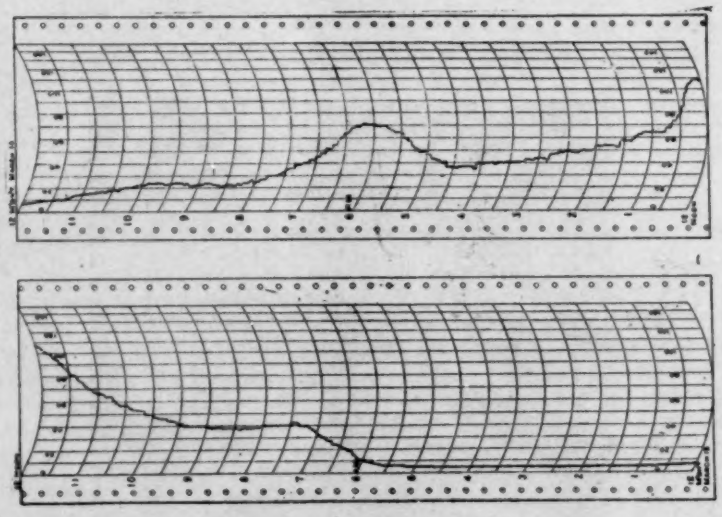

**Fig. 12.**—Graphic chart showing the varying rate of sendout of gas to the city of Madison on Saturday, March 14th, 1914.

a demand chart for the city of Madison for Saturday, March 14th, and Fig. 13 the corresponding chart for Sunday, March 15th.

What first attracts attention on these charts is the shape and height of the maximum peak load. Although by simultaneous readings of wet station meters and holders it is possible to obtain approximate information regarding these peaks, the ability to have them faithfully traced in every detail without the necessity of any reduction to standard units was unheard of until the heat method of measurement was developed. The maximum height to which this peak load rises during the year is at once an indication of the required capacity of the storage holders, the compressors, and the pipe line for the maintenance of efficient service. Another important feature is the variation shown in the demand during the different days of the week, different seasons of the year, special holiday seasons, and extreme weather conditions. Some of these variations are illustrated on the two charts shown. If a superintendent finds such a chart on his desk each morning while these special conditions are still fresh in his mind, he will acquire a knowledge of the demand which he is aiming to serve that should not only prevent irregularities in service but should help to maintain increased efficiency of operation. The minimum points which usually occur between 1 and 4 in the morn-

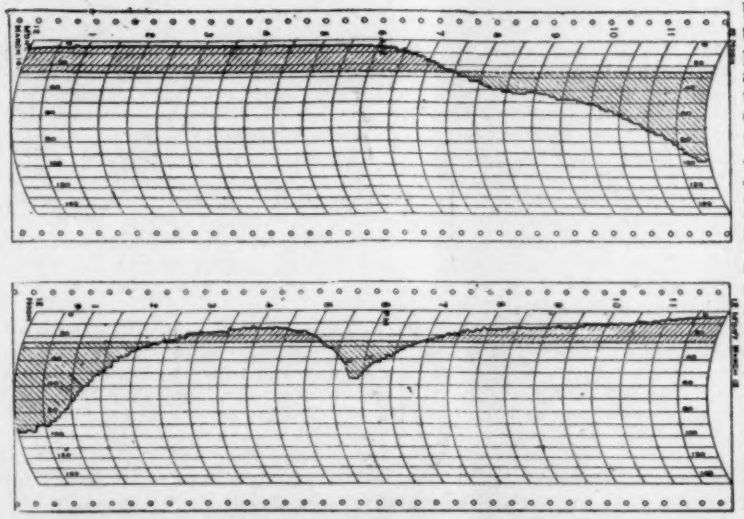

**Fig. 13.**—Graphic chart showing the sendout to the city of Madison for Sunday, March 15th, 1914. Note the difference in the characteristics of the Saturday and Sunday demand. The dotted line shows the average demand for the 24-hour period.

ing are a very good indication of the condition of the piping system as to leakage. During these hours the demand is very limited in an ordinary city and can be quite accurately ascertained. With a knowledge of this small demand and a record of the gas leaving the holders, a quite definite indication of the leakage or unaccounted for gas can be had.

In Fig. 13 the line of average flow for the 24 hours is shown. This value of average flow can be obtained from the totalizing meter or by an integration of the chart. The average line represents the desired rate of gas make for the day while the curve traced by the meter represents the varying rate at which this gas is sent out. The shaded areas between these two lines furnish a direct and comprehensive knowledge of the requirements for gas storage. Had such graphic diagrams been available a much more definite knowledge of storage requirements would prevail to-day, and storage capacity is one of the important features in the first cost of a system.

So long as low pressures obtained in these sendout systems it would have been physically possible to measure the gas at these points in the system with the former methods available but the cost of an installation that would safely handle the peak loads as compared with an installation that will handle the normal average load would be prohibitive. One of the economic features of the Thomas meter is its low first cost and the slow rate of increase in this cost as the maximum designed capacity increases. There is, of course, a charge for electrical energy consumed, but since the heater energy varies with the rate of flow the energy charge over a monthly period is somewhat in proportion to the average rate of flow. The total cost of measuring gas by this method is made up of interest, maintainance and depreciation, and an energy charge in proportion to work done. The annual cost of a wet meter installation is made up entirely of interest, maintainance and depreciation, but this first cost will be very high for installations that can safely handle the peak loads. The Thomas meter compares very favorably with the wet meter as to total cost for station meter service where the rate of flow is steady and where there are no high peaks. A similar comparison for sendout service would show a tremendously greater advantage in its favor, but such a comparison would scarcely be fair since this service is not within the scope of the wet meter. The remarks on the Thomas meter for sendout service applied to its use as a large consumer's meter as at *C* (Fig. 1). It applies even more forcibly to its application to the measurement of high pressure gases sent to distant towns. In the high pressure distribution field the Thomas method of measurement stands alone in its ability to measure accurately the gases which pass at any pressure and temperature, and still give results on both a totalized dial and graphic chart in standard units of gas without any reductions or corrections. The tendency toward high pressure distribution to distant towns from central manufacturing plants will result in the installation of meters in somewhat isolated stations as at *E* (Fig. 1) where they are not under continuous observation of the superintendent, but are cared for by periodic inspection by some one of his staff. This makes it important that meters be used which will run for as long as possible without attention; and it is very desirable that the design of the meter be such that a periodical inspection will assure the operator that it is not only operating satisfactorily but that those parts which may affect accuracy are in perfect condition. The Thomas meter needs no daily attention. The elements inside the gas main have no moving parts and need no inspection or cleaning even when working in the dirtier gases. All of the mechanism connected with the automatic control device is built as rugged as possible and is mounted on the recording panel in the most favorable place for continuous operation with the least care. These moving parts must, of course, be oiled periodically. The two features which enter into the accuracy of the measurement are the temperature control system by which the temperature rise in the gas is maintained constant and the electrical measuring system. As Professor Thomas points out the zero balance of the control system is very easily checked from the recording panel without dismantling any parts and without shutting off the gas in the line. This is accomplished by breaking the heater current, thus allowing the flowing gas to bring the two thermometers to the same temperature, shunting out the temperature difference resistance in series with the entrance thermometer, and allowing the galvanometer needle to come to its zero position, thus proving that the thermometer units are in perfect condition. Once this zero balance has been checked there can be no doubt as to the amount of the temperature rise in the gas and the only remaining question is as to the accuracy of the wattmeters. From the graphic chart and the daily observations on the dial of the watthour meter the two wattmeters may be very easily checked against each other. Furthermore connections are provided on the panel so that either or both of these wattmeters may be checked with standard electrical instruments. The checking of the zero balance corresponds almost exactly with the checking of the water level on a wet meter, each constituting the zero point from which measurement is made. The control system in the Thomas meter is so designed that this zero balance should remain constant, but provision is made for checking it very quickly, and any variation can be easily corrected. After these two features have been checked the operator may be sure of the accuracy.

In the consideration of measuring devices for the solution of these new problems must be borne in mind the ever increasing demand in all commercial measurement work for simple direct results on a dial which may be easily observed at intervals and entered on permanent records with the least modification possible; and a continuous graphic chart to show the operator just what has happened during each moment of the period. When this is accomplished, the influence of the human factor has been reduced to a minimum and the maximum possible information is furnished to the operator.

# Special English Correspondence.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, July 20, 1914.

*The Liverpool Meeting of the Inssitution of Gas Engineers.—Regulations Governing Outside Lighting, etc., in London.*

The annual meeting of the Institution of Gas Engineers for 1914 is now a thing of the past. It was in every respect a success, and those who were so fortunate as to be able so attend had a most enjoyable time. Perhaps the principal feature of the business meeting was the subordinate position accorded to what is usually understood to be the principal object of the meeting, the hearing and discussion of papers. Out of three sittings, it was near to the close of the second before the item of "papers" was reached, and that notwithstanding the fact that the President had obviously applied the scissors with some energy to his inaugural address. Out of four papers, not an exorbitant number, one was not discussed at all, and another very perfunctorily. It really seems that the "paper" is drifting down to the Junior Societies. Two of the readers endeavored to assist matters by leaving out portions of their contributions, and suggestions have been put forward to the effect that the discussions might be extended by means of written replies, to be included in the published transaction, that they might be continued in the technical press, or that two or three of the district associations should take up some of the broken threads. As a matter of fact, nothing of any importance will come of these suggestions. The time for discussion is immediately after the reading of the paper, and no other. Even an adjourned discussion is rarely a success. There is a flatness about it, and a tendency to discuss the previous speaker rather than the original communication. For some years it has been notorious, especially in London, that a full audience could not be got together at the Institution meetings after lunch, and now it appears that this applies to some extent to the morning. Various suggestions have been made about taking papers as read, and publishing them a fortnight in advance. But after some years experience on the committees of district associations, I question whether even Mr. Dunn, who can certainly do as much and probably a good deal more than the average secretary, would ever succeed in getting them three weeks in advance. If the truth was told, I expect he would be thankful to be sure of getting them within three days.

As on previous occasions, the number of topics not noticed at all, was as remarkable as those that were. Within 20 years, the slot user has grown until we find that to-day he is far more numerous than the ordinary. So far as the Institution is concerned, he might not be in existence. There is a growing demand for superior, more artistic, and more scientific lighting, and several other agencies are sparing no effort to meet it. But the Institution has not a word to say about lighting. During the last two years the prices of coal and of oil have substantially advanced, to such an extent that the resources of those who wish to avoid increasing the price of gas are strained to the utmost, but this trifling detail is apparently not worth attention. We have just completed a years experience with the new national health, and unemployment compulsory insurance, which is practically an additional tax on employers, but the Institute, like Gallia, cares for none of these things.

Passing on to the actual proceedings, the topics dealt with were important questions of the day. The lecture by Dr. Carpenter, illustrated by demonstrations and by a remarkably fine set of drawings, was an event, even amongst the high class lectures that have been delivered to the Institution in the past. And it is impossible not to feel a keen sympathy with his desire that gas, like Cæsar's wife, should be above suspicion; and as keen an appreciation of the ability with which he has attacked, and to a large extent successfully

a problem that has defied the highest scientific talent available in our country for over half a century. Over 2,000 million cubic feet of gas have been treated by the catalytic process, at Old Kent Road Gas Works, since Jan. 1, 1914, with the result that the sulphur compounds have been reduced 80 per cent., viz., from about 40 to 8 grains per 100 cubic feet of gas, and that without any effect on the composition of the gas beyond a reduction in the naphthalene, to which no one will object. I may, in passing, observe that a most amusing blunder has been made by "our own correspondent" to an important daily newspaper, who has waxed appalingly eloquent over the pernicious effects of 40 grains of sulphur per *cubic foot of gas.* He has evidently overlooked the 100. At the Greenwich Station the process has been at work for 2 months, during which time 483,000,000 cubic feet of gas have been treated, with somewhat similar results. Mr. Schieldrop, of Bergen, Norway, came a long journey, part of it over mountains covered with snow, to describe some special features in gas works practice in Norway. Some of these, such as a ready sale for coke at more than twice the price of coal delivered on the works, were enough, as was pertinently stated in the discussion, to turn an English manager green with envy. But a fly in the ointment is exceedingly cheap electricity provided by water power. Some interesting examples of a graphic method of representing results as arranged by the Norwegian Society of Gas Engineers, were exhibited, and incidentally it may be observed that the consumption of gas at Bergen has doubled within the last 6 years. Mr. Jacques Abady gave a summary and review of the present position as regards the Calorific Power Standard, if such a thing can be said to exist. The word "Standard" implies something of universal or at least general utility. But, according to Mr. Abady, "it is apparent that the settlement of an adequate Calorific standard will be considered separately by Parliamentary Committees—each case on its own merits. Further than this, it is an open secret that this is the view held and expressed by the Board of Trade." The hopes of those who have looked to the calorimeter as a means of ending the confusion caused by the existence of three or four different standard burners, and a candle power, as rated by the No. 2 Metropolitan burner, of anything between 12 and 20, are dashed to the ground. Already nine undertakings are under legal calorific power tests, but only seven are subject to penalty. The "standard" ranges from 500 to 540 B.T.U., but the ', penalty point" is in all cases 50 to 65 B.T.U. below the standard, so there may be a defection from the so-called standard, to the extent of 10 or 12 per cent. without penalty. The introduction of practically two figures is a mistake likely to lead to complication, and injury of the industry. Perhaps it is the intention of the companies to keep to the higher figure, but, rightly or wrongly, they will be credited with having a keener eye for the penalty point, and in calculations involving comparisons with other methods of heating, the lower figure will be invariably selected as the correct indication of the value. The demand of the day is for uniformity. and surely it is possible to run from one years' end to another (extraordinary circumstances excepted) with a variation not exceeding 5 per cent. Inability to do so, at this stage, is almost a confession of incompetence. It would be preferable to copy the photometer to the extent of having one figure only, and the proviso that the company will not be liable for any failure that can be shown to be due to causes beyond their control, No one would think of adding to a 16-candle power standard the proviso that penalties should commence at 14. The tendency is to reduce the variation, as in a bill promoted this session by the Liverpool Gas Company, a standard of 550 B.T.U. and a penalty point of 522½, or 5 per cent. below has been accepted. Mr. Abady remarks that we have now arrived at a point, in regard to parliamentafy practice, that includes absolute removal of any standard of illuminating power, the reduction of the margin between the standard and the penalty point to 5 per cent. and the establishment of the fact that the parliamentary calorific standard shall be such as is shown by apparatus so arranged and operated as to indicate the total gross heat value of the gas. Though the flat flame candle power test is still retained for information purposes only, as some protection for the flat flame user, he is of the opinion that this will prove to be a temporary arrangement. Mr. Abady advises all gas undertakings who may be thinking of applying to be placed under a calorific standard, to study the requirements of their district and ascertain by experiment what figure would be an ideal one for such district. Also to investigate the possible yield in heat units from the various materials, coal or other, that are available, as compared with prices at which they are obtainable, and the influence upon calorific power of all the possible available methods of carbonization. It is necessary that there should be a sufficient margin between the penal point and the standard to cover variations in working conditions, and also to leave a free hand both in respect to materials and processes.

The contribution by Mr. G. T. Purves, on the application of coke oven carbonizing and Otto direct ammonia recovery to gas works requirements, comes appropriately at a time when, on account of the high price of staple material, every method of increasing yields, or reducing working costs, is receiving careful investigation. But recent experiences in the sulphate of ammonsa market are not likely to rouse great enthusiasm over increased yields of ammonia. The fact that the author of the paper is a member of a junior gas association accentuates my remarks on papers in connection with the Institution. He obtained, over last year, an average of 79 per cent. of coke, as compared with the coal used, and over 94 per cent. of the coke was large, and sold at a price of 7s. in advance of that obtained for local gas works coke. Special attention has not been given to the make of gas, but it is believed to approach 10,000 cubic feet per ton, and the composition, as shown by analysis, is about the same as 14 candle (No. 2 Metropolitan) coal gas. A calorific value of 560 B.T.U. net, which is equivalent to 620 B.T.U. gross, is claimed for it, which appears somewhat high, considering that the gas averages 6 per cent. nitrogen and 3½ per cent. carbonic acid. Judging from the composition one would expect 560 B.T.U. gross to be nearer to the mark. He states that gas of this quality is to be supplied on a profit making basis at 4d. per 1,000 cubic feet. This is by far the cheapest calorific value yet supplied, leaving Widnes in the shade, and it affords a solution of the gaseous fuel problem, and incidentally of the commercial prospects of coal merchants and chimney sweeps, so far as that fortunate district is concerned. The paper by Mr. John West, on the uses of sulphate of ammonia, was interesting and valuable, but applicable to English conditions of climate only, and therefore does not call for detail notice here.

The London County Council are proposing to apply to the local Government Board for approval of a set of by-laws regulating the dimensions and weight of lamps, signs, and other structures overhanging the public highways. The by laws will not apply to existing fixtures, or to any lamp, or support for the same, fixed at a height of not less than 7½ feet clear, not projecting more than 3 feet, not less than 2½ feet clear from the outer edge curb line, and solely for the purpose of illuminating the shop windows. And the lamp itself, inclusive of accessories, shall not exceed 36 inches in height, 24 inches wide, and 24 inches parallel to the building. Or to rails or pipes not projecting more than 2 feet clear from the building, and not less than 7½ feet clear above the footway. Or to public lamps. Or to existing lamps, including replacement or re-erection not exceeding the original dimensions. With these exceptions, no person shall, after the passing of the by-laws, erect any lamp that, including accessories, exceeds 5 feet in any dimension vertically, or 3 feet in any dimension horizontally, or weighs more than 84 pounds, or is not provided with a second support capable of bearing the whole weight. Seven clear days notice is to be given to the local authority before fixing, and the Council may, subject to consultation with the local authority, dispense with the by-laws in any case where they may consider it expedient to do so.

## Items of Interest
### FROM VARIOUS LOCALITIES.

E. G. Lege, of the Galveston Gas Company, read an interesting paper on the difference between high pressure and low pressure gas plant operation at the last meeting of the Good Service Club of the Galveston Gas Company. The following were present: J. Jersig, William Bergman, George Kirchner, C. Carlson, William Vanden Ende, G. Theoboldt, Ed. Schutte, J. R. Davis, J. A. Peterson, I. J. Lightfoot, W. A. Larsen, A. L. Bartzen, J. A. Greenwalt, Ed. Kirchner, J. M. Meyer, P. E. Nicholls, E. G. Lege and William P. Hughes.

Manager S. E. DeFreese, of the Chattanooga Gas Company, announced recently that residents of Missionary Ridge could realize their hopes of having gas as soon as the business league had secured enough names on the contract to warrant the running of a main from Ridgedale to the top of the hill. If the promise of the league can be secured, to the effect there will be as many as one resident for each 125 feet of pipe, the installation will be started at once.

Announcement has been made of the officers and directors of the Ohio Cities Gas Co., recently organized through a consolidation of the Columbus Gas & Fuel Co., the Federal Gas & Fuel Co., the Columbus Oil & Fuel Co., the Springfield Gas Co. and the Columbus Producing Co. Beman G. Dawes heads the new company as President, with W. E. Hutton, of Cincinnati, Vice-President, and Fletcher Heath, Secretary. Mr. Dawes and Mr. Hutton are also President and Vice-President, respectively, of the Columbus Gas & Fuel Co. The directors of the new company include the officers and Warren C. Fairbanks, Chicago; Paul Martin, Springfield; H. M. Work, New York; L. G. Addison and W. F. Burdell, of Columbus. It was stated that the results of the Ohio Cities Gas Co. are exceeding the estimates made prior to its organization and are showing most thriving conditions. Despite the decline in oil prices, and the unfavorable conditions for gas consumption, the earnings are running in advance of expectations.

The candle power, heat units and pressure of the gas being supplied to consumers by the Providence (R. I.) Gas Company compare favorabiy with the same qualtties in the product furnished to the cities of Boston, Fall River and Worcester, by companies in those places, according to a report from Public Service Engineer Robert L. Brunet, submitted to the Providence City Council committee on lighting franchises. Mr. Brunet's report was made following a long series of tests with gas from all four cities, and shows that the product of the Providence Gas Company is not below that of other companies in other cities, as has been charged.

THE operating results of the Albany (Ga.) municipal gas plant as published by the authorities, can hardly be considered encouraging to other towns considering such operation. The report for the second quarter of 1914, is as follows:

| | |
|---|---|
| Collections | $2,021.85 |
| Operating expenses, etc | 2,789.03 |
| Deficit | $767.18 |

ABOUT 40 per cent. of the employees of the Pacific Gas and Electric Company have subscribed to the new preferred stock offered them by the Company. A preliminary tabulation indicates that subscriptions to date have been received from 1,330 employees for a total of $453,400 par value of stock.

THE St. Joseph (Mo.) Gas Company recently elected Robert R. Clark a Director to succeed the late James Campbell, of St. Louis, and made Albert V. Schaeffer Secretary, to succeed Ferd Labrunerie, resigned.

GEORGE M. CULVER, of Denver, who secured a franchise for a gas plant in La Junta, Col., about 8 months ago, is making the final arrangements to commence work on the plant. B. H. Joy, of Chicago, represents a syndicate of capitalists who are considering the financing of the enterprise, and states that they will in all probability take up the proposition. It is the plan of the promoters to build a plant in La Junta from which both La Junta and Rocky Ford will be supplied.

THE Columbus (Ind.) Gas Light Company have been giving a series of well attended demonstrations in their offices. Daily prizes of gas appliances were given to the women attending, and on some days there was scarcely room enough for the crowds that wanted to see how to do it with gas.

THE Auburn (Wash.) Gas Company, recently incorporated for $50,000 and granted a franchise by the City Council, has elected the following officers: Frank N. McCandless, of Tacoma, President; John March, of Tacoma, Vice-President; J. L. Veach, of Auburn, Secretary, and James H. Spencer, of Tacoma, Treasurer. W. C. Morriss, also of Tacoma, was elected General Manager.

IT is reported that the Waterbury (Conn.) Gas plant is on the market and the New Haven road is about to get rid of its gas property. Since the United Gas Improvement Company gave up the property at the expiration of its lease, the New Haven Railroad has been running the business at a good profit. But it wants to wash its hands of properties that are not in keeping with its intended line of business, and efforts are being made to dispose of the Waterbury franchise and holdings before federal or other action is taken divorcing such monopolies or commercial activities from the business of legitimate railroading. The proposition is being handled with care and judiciously, it is understood, so that the transfer may be brought about with a reasonable amount of profit and to responsible parties. The Waterbury franchise is an excellent business proposition and one that should command a ready sale.

THE Battle Creek (Mich.) Gas Company is no more. Instead, there is the Calhoun Gas Company, and Battle Creek gas consumers will pay their bills to the new company next month. The reorganization of the company, under the new name was announced some time ago, when the articles of incorporation were filed with the Secretary of State. Under the new organization, the company has been capitalized for $600,000. The officials of the Calhoun Gas Company are: E. Henning, President; David H. Frazier, Vice-President and General Manager; E, B. Zimmer, Secretary and Treasurer; F. P. Remmington, General Superintendent; W. O. Weekes, Commercial Manager.

PATRICK HARKINS, 70 years old, one of the most widely known men in Brookline, Pa., died last week at his home on the Alston road. For a month he had been suffering. Death resulted from general debility. Mr. Harkins, for nearly 39 years, tramped the streets of Ardmore and vicinity lighting gas lamps, and became one of the most familiar figures in that town and Brookline. A short time ago the United Gas Improvement Company, recognizing his efforts through years of service, pensioned him.

GEORGIA is showing great activity in installing gas plants, franchises having recently been granted in Gainesville, Griffen, Milledgeville, Fitzgerald, Cordele, Cedartown and Newnan. This indicates a healthful development of small towns, and that the State Commission by its regulation is attracting capital to public utilities.

MR. A. S. B. LITTLE, General Manager of the Consolidated Gas Purification and Chemical Company and the Atlas Paint Company, of Nashville, Tenn., announces that he has resigned his connection with those companies, to take effect October 1st. While both companies and Mr. Little have had gratifying success, he wishes to get back into active gas operating, and is considering several propositions of that nature.

THE Davis & Farnum Manufacturing Company, of Waltham, Mass., have been awarded the contract for erecting a 100,000 cubic foot holder for the Athens and Sayre Gas Company. The holder will be for additional storage at the Athens, Pa., plant.

THE Bristol Company, for serving its customers in the vicinity of Boston, has established a district branch office at Boston, with Mr. F. H. Emerson as Boston District Manager, in the Old South Building. This year is the 25th anniversary of the founding of The Bristol Company, and it is interesting to know that the plant has grown at the rate of doubling the floor space every 5 years during the last 20 years. The growth of the business has been especially large during the 6 years since 1908, when Mr. Wm. H. Bristol again took up the general management of the Company.

THE ornamental street lighting fixtures used in Lebanon, Pa., carry Humphrey gas arcs, and the extensions of the system now contemplated will use the same equipment. In the JOURNAL of July 6th we quoted an item referring to them as Welsbach installations.

GENERAL SUPERINTENDENT E. M. STACK, of the Scranton (Pa.) Gas Company can always find something new for an advertising feature. Not long ago he advertised his readiness to buy every coal range in Scranton whose owner would substitute a gas range. One of his specialties is drive sales. For instance, he advertised for Saturday July 11th, a sale of 1,000 gas irons at $1.25 each, the sale to begin at 8:30 A.M., and continue until the thousand were sold. For the week beginning July 18th, he put 500 regular $17 gas ranges on sale at $12 95 connected. He advertises the "sales" just far enough ahead to keep them fresh, and he is generally sold out before the time limit.

IT is said that the troubles in North Tonawanda, N. Y., regarding the cutting off of its supply of natural gas may be solved by getting a supply of gas from the coke oven plant to be built by the Wickwire Steel Company on Rattlesnake Island.

ON July 1st, the Napoleon and Wauseon Gas Company was transferred to the ownership of the Ohio Gas Light and Coke Company. It is the intention of the newly organized company to take over the gas plants recently built at Bryan and Montpelier and operate Napoleon, Wauseon, Bryan and Montpelier—from the head office of the Ohio Gas Light and Coke Co., which will be located at Napoleon. The new company will be a half million dollar concern and expects eventually to supply artificial gas to all large towns in Northwestern Ohio.

DURING fiscal year ended June 3 last, sales of gas by the Boston Consolidated Gas Co., established a new high record of 5,200,000,000 cubic feet, an increase of 151,000,000 cubic feet, or 3 per cent. This compares with 5.5 per cent. increase in previous year. At the present time the company's sales of gas to consumers are larger by 2,152,000,000 cubic feet per annum than when it began operation on July 1, 1905, following the consolidation of the several gas companies.

# Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,103,112. Proc ss and Apparatus for the Treatment of Coal, Shale or the Like in Vertical Retorts. A. Waddell, Dunfermline, Scotland.

1,103,249. Gas Filter. A. J. Bassett, Milwaukee, Wis., assignor to Sharp-Bassett Gas Producer Co., same place.

1,103,253. Burner. H. S. Bennett, Cleveland, O.

1,103,365. Inverted Burner Gas Lamp. L. B. London, New York city.

1,103,397. Gas Burner. Charles F. Cole and Q. Carr, Huntington, W. Va.

1,103,517. Device for Lighting and Extinguishing Gas Lamps. J. and G. Keith, London, England.

1,103,566. Gas Burner. G. B. Cobb, Jr., Philadelphia, Pa., assignor to Vesta Mfg. Co., same place.

## Utilities Commission News.

REDUCTION FOR EAST BOSTON, MASS.—The price of gas in East Boston after August 1st will be 80 cents per 1,000 cubic feet, according to an order issued recently by the Gas and Electric Light Commission. This is a reduction of 5 cents. The decision of the Commission was not altogether unexpected, as it was stated by Governor Walsh a month ago, when he vetoed the bill requiring the reduction on the part of the East Boston Gas Company, that the Commission was then considering the question and would soon hand down a decision.

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CUMBERLAND (MD.) COMPANY TO LIQUIDATE.—The Maryland Commission has before it the petition of the Cumberland Gas Light Co. for permission to close its plant and go out of business. It was brought out in testimony that the company was incorporated in 1853, and laid pipes for the distribution of gas for lighting and heating purposes. In 1884 the Edison Electric and Illuminating Company was formed, and by the introduction of electric light decreased the Gas Light Company's business. Finally, in 1906, the West Virginia and Maryland Natural Gas Company entered the city and gas rates were reduced. The petitioners claim that they have been losing business and operating at a loss ever since. Their mains are in need of repair, but they lack the funds required for the improvement. After hearing the testimony, Commissioner Timanus decided to take the matter under advisement, and will announce his decision later. It is expected a favorable answer to the petition will be received within a brief time, and steps will be taken by the gas company to go out of business.

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RESIGNS FROM MARYLAND COMMISSION.—Mr. Philip D. Laird, chairman of the Maryland Public Service Commission, has sent his resignation to Governor Goldsborough, effective on August 1. In resigning, Mr. Laird is carrying out a determination made about a year ago. The hard work, which is constantly increasing, is making inroads on his health.

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IDAHO COMMISSION UPHELD.—The State Supreme Court has handed down a decision upholding the constitutionality of the public utilities law and the legality of the acts of the commission. The cases involved were those in which the commission issued orders refusing certificates of convenience and necessity for the Idaho Power and Light Company to enter Twin Falls and the Beaver River Company to enter Pocatello. The Great Shoshone and Twin Falls Water Power Company was already rendering service in Twin Falls, and the Southern Idaho Water Power Company in Pocatello.

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ICE IS NOT A PUBLIC UTILITY.—The public welfare committee of Los Angeles, Cal., has reported to the City Council that in its opinion the Council cannot regulate the price of ice. The Council adopted the report. The question of regulation of the price to be charged for ice arose from alleged discrimination.

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OHIO DEPRECIATION ACCOUNTS.—Mr. E. W. Breyer has been employed by the Ohio Public Utilities Commission to prepare a system of depreciation charges applying to public utility companies. Mr. Breyer does not employ the word "depreciation" in his system, but rather contemplates the creation of reserves by contemporaneous charges to operating expense accounts to provide for defraying the cost of "extraordinary maintenance, deferred upkeep and contingencies." By the term "extraordinary maintenance" Mr. Breyer contemplates large repairs, but something less than the replacement of an entire unit. This would come about through deterioration of buildings or equipment for a long period of time. "Deferred upkeep" would mean the necessary replacement of complete units, retired by inadequacy, advance in the art or because of obsolescence. "Contingencies" would cover losses by fire, flood, earthquake, storm, etc. Corporations must be given the trusteeship of the funds accumulated for these purposes, as representing trust funds paid in advance by the public, according to the Commission's idea, and it is not contemplated that these funds should remain idle. The funds may be used for working capital or for financing extensions and improvements temporarily. Interest must be paid and evidences of indebtedness to the trust funds must be given.

## Financial Notes.

ALL of the stock of the Danville Gas Company, of Danville, Ky., has been deposited with the Fidelity and Columbia Trust Company in preparation for a sale to the Commonwealth Power, Railway and Light Company. The acquisition of this plant gives local connection with the Commonwealth Company, a large volume of whose securities are held throughout Kentucky. The price paid for the property has not been announced, but it is understood to have been better than par. J. A. Cheek, of Danville, is president of the company.

A. B. LEACH, President of the Columbia Gas and Electric Company, denies that there are any negotiations under way which would involve either the change of ownership or management of the Columbia Gas and Electric Company. It has been freely rumored during the past week that the Dawes interest of Chicago, which controls the Ohio Cities Company, has opened negotiations with the Columbia Gas Company for the purchase of control of the Columbia Gas and Electric Company, through a change of securities. Another rumor was to the effect that Beman G. Dawes, President of the Ohio Cities Company, was to succeed Mr. Leach as head of the Columbia Company. It is possible that there may be a deal arranged between Columbia Gas and Electric Company and Ohio Cities Company by which a large acreage of gas territory in West Virginia, owned by the latter, may pass to Columbia Gas and Electric in exchange for certain securities of the latter.

STOCKHOLDERS of the Portland (Me.) Gas Light Company have authorized the issuing of 6,000 shares of the capital stock of the Company in accordance with the provisions of the amendment to the charter of the Company adopted by the Legislature.

THE following regular quarterly dividends have been declared payable July 15 to stockholders of record July 1st:

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| Binghamton Light, Heat and Power Co., | Preferred Stock, | 1¼ | per cent. |
| " " " " " " | Common " | ¼ of 1 | " |
| Sayre Electric Company ..... | Preferred " | 1¼ | " |
| " " " ..... | Common " | 1 | " |

These companies are among the subsidiary and affiliated companies of the Atlantic Gas and Electric Company.

THE half year's returns in gross and net of the People's Gas Light and Coke Company (Chicago) show an increase over those of the corresponding period last year. Gross has been a normal increase, while the gain in the net has been very largely due to economies of operation under the new management.

THE Youngstown (Ohio) Consolidated Gas and Electric Company has been sold to the Youngstown and Sharon Street Railway Company, and the approval of the Utilities Commission of Ohio to the transfer is sought. The application states that the purchaser is to pay the amount of the capital and surplus and assume the outstanding bonds. A report for last year showed capital stock, surplus and all other values included, to be $3,512,000. Of that amount the outstanding bonds amount to $545,000.

CONSOLIDATED gross earnings of the subsidiaries of American Power and Light Company, consisting of Kansas Gas and Electric, Portland Gas and Coke, Pacific Power and Light and Southwestern Power and Light subsidiaries, for May were $507,290, an increase of $59,792, or 13 per cent. over May, 1913, while operating expenses and taxes were $278,088, an increase of $29,747, or 12 per cent., leaving net earnings for the month of $229,202, a gain of $30,045, or 15 per cent. For the 12 months ended May 31 gross was $6,189,281, an increase of $693,895, or 13 per cent. with operating expenses and taxes of $3,315,875, an increase of $246,272, or 8 per cent. Net earnings were $2,873,406, a gain of $447,623 or 18 per cent.

THE drop in market value of Laclede Gas common stock is not relatively more than the stocks of many stable companies have suffered. In 1909 large blocks of this stock were bought by bankers having other interests, and it is possible that these men have been selling stock to meet other demands merely because the stock has a market and the company is in sound condition. It is interesting to note the price range of the common stock. In 1910 the range was 93¾ to 116½; in 1911, 101 to 114½; in 1912, 102 to 108, and in 1913, 90¾ to 104½. For the period of three months ending March 31, 1914, surplus earnings after payment of interest, depreciation, and preferred dividends are reported as $214,310, compared with $240,821 for the same period a year previous.